City of Palo Alto
City Manager's Summary Report

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TO: HONORABLE CITY COUNCIL

FROM: CITY MANAGER **DEPARTMENT:** City Manager

AGENDA DATE: August 5, 1996 **CMR:361:96**

SUBJECT: **Telecommunications Strategy Study -- Phase 4 Results and Recommendations**

REQUEST

This report requests that Council approve the Utilities Advisory Commission (UAC) recommendation for the Electric Utility to develop a fiber optic ring around Palo Alto.

Prior to unanimous endorsement by the Utilities Advisory Commission, the Telecommunication Advisory Panel (TAP), formed at the start of the project, reviewed the Phase 4 report and provided feedback to staff. Six of the seven TAP members attended a meeting to discuss the Phase 4 report and unanimously endorsed the recommended strategy.

RECOMMENDATIONS

This report recommends that the City Council:

1.) Approve a Budget Amendment Ordinance requesting the use of $2,061,600 from the Electric Rate Stabilization Reserve to fund a positioning strategy involving Electric Utility development of a dark fiber ring to be co-located in conduit and on poles with existing Utilities' communications lines.

2.) Approve keeping the commercial telecommunications assets separate from the Electric Fund rate base upon which General Fund transfers are calculated.

3.) Convert Phase 5 of the Telecommunication Strategy Study from business plan development to strategy implementation.

POLICY IMPLICATIONS

The recommended positioning strategy involving Electric Utility development of a dark[1] fiber optic ring would be an extension of the City's long-standing policy of providing utilities infrastructure for the citizens and businesses of Palo Alto. Implementing the strategy would leverage existing Electric Utility infrastructure to initiate the City's involvement in providing telecommunications infrastructure.

Expenses for the study to date have been taken from the Electric Rate Stabilization Reserve. Most of the implementation costs are also proposed to be funded by the Electric Rate Stabilization Reserve as described in the proposed Budget Amendment Ordinance included as Attachment 3. The proposed telecommunications program will be a subfund of the Electric Fund and will appear as a new Functional Area in the Electric Fund. When a positive cash flow is realized, staff will review revenue projections and ongoing funding needs and recommend a period over which repayment of the Electric Rate Stabilization Reserve should occur.

The changes to the *1996-1997 Adopted Budget* that would occur as result of implementing this strategy are presented in Attachment 4. Additionally, in a future Budget Amendment Ordinance that will be presented to Council, one staff position will be requested for FY 1996-97 to assume general responsibility for the City's commercial telecommunications activities. It is further anticipated that a second staff position may be requested in FY 1997-98 to maintain the system.

Staff is recommending that the telecommunications asset base be kept separate from the electric distribution system asset base and not used to determine the transfer to the General Fund. This differs from the City's long-standing General Fund transfer policy for existing utilities involving an equity transfer that is based upon the risk that was initially imposed upon the General Fund when these utilities were created. For the proposed telecommunications activities, no such risk would be taken by the General Fund. Instead, the risk would be borne by the Electric Utility with the belief that the risk is limited and that the recommended strategy will diversify the Electric Utility's revenue streams into a growth market and better position the Electric Utility for impending competition in the electric utility industry. For this reason, staff believes that including the telecommunications assets as a part of the Electric Fund rate base upon which General Fund transfers are calculated would not be appropriate.

The Electric Utility's involvement in telecommunications would initially be limited in nature, but could later be expanded if deemed appropriate. While the recommended strategy involves limited financial commitment, it has the potential to deliver substantial benefits to the Palo Alto community. The recommended strategy was identified as the City telecommunications strategy

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[1] "Dark" fiber implies that the project will not include electronics. Electronics, including light transmitters and receivers, would instead be added by those companies that activate fibers and transmit light through them.

that best achieves the telecommunications objectives approved by the City Council on February 26, 1996 (as described in the Discussion section of the City Manager's Report that follows).

Additionally, in response to the passage of the Telecommunications Act of 1996, staff is developing policy guidelines for the use of the public rights of way for telecommunications infrastructure development. Staff will report back to the City Council after these guidelines have been drafted.

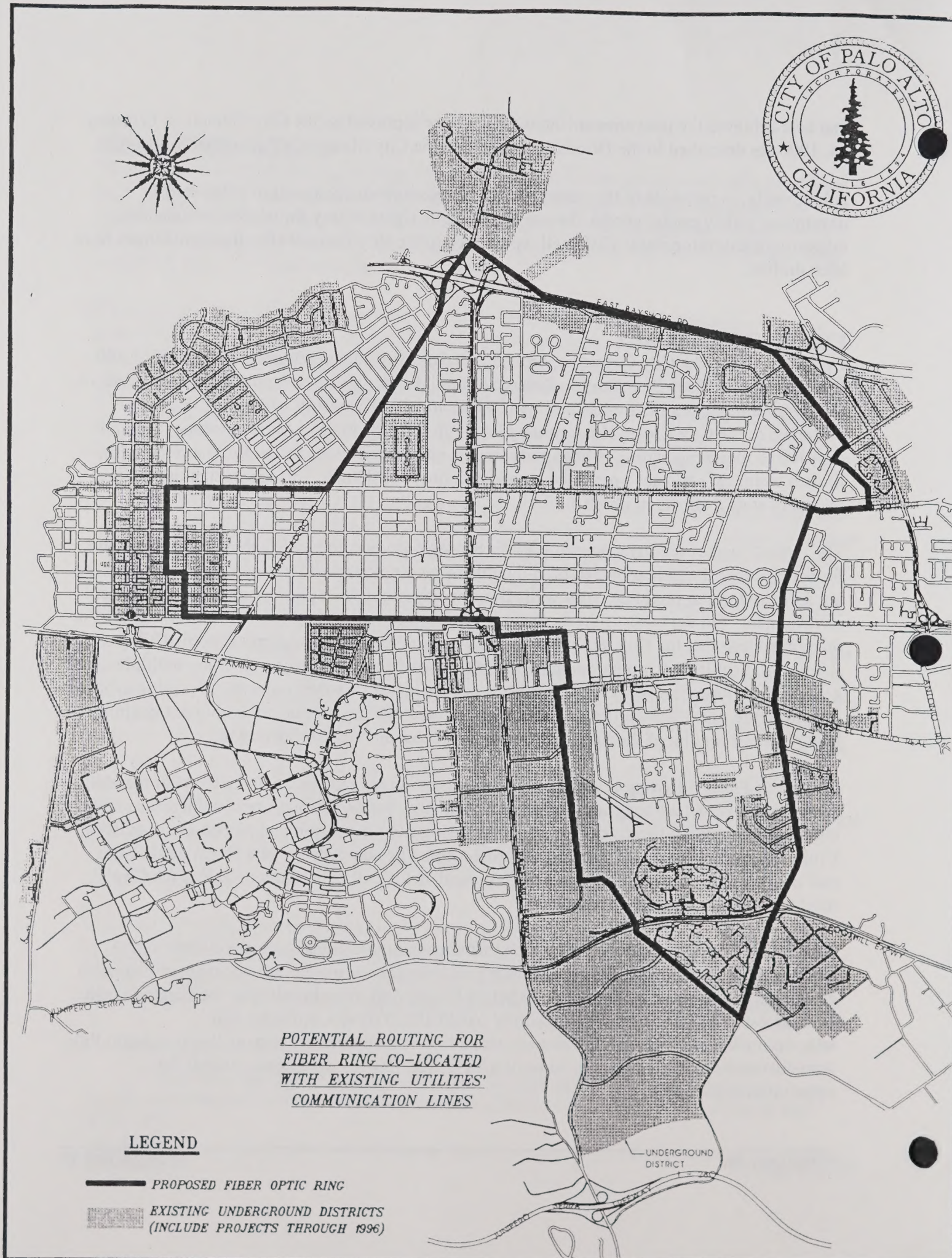
EXECUTIVE SUMMARY

On May 8, 1995, the City Council approved a Budget Amendment Ordinance to use $135,100 from the Electric Rate Stabilization Reserve to fund the five-phase consultant study to develop a telecommunications strategy for the City (CMR:240:95). The results of Phases 1-3 were presented to the City Council on February 26, 1996 (CMR:150:96). At that meeting, Council approved a recommendation to have staff assume responsibility for Phase 4 of the study with limited technical assistance provided by one or more consultants. This report summarizes the results of staff's efforts in Phase 4.

The overall goal of the Telecommunications Strategy Study is to identify the best City strategy for accelerating the pace at which high-quality, low-cost, advanced telecommunications services are delivered throughout Palo Alto while limiting any negative impacts on Palo Alto's physical environment. On the basis of the extensive evaluation described in Attachments 1 and 2, staff is recommending that the City implement a positioning strategy by having the Electric Utility develop a 15-mile fiber ring around Palo Alto that would be capable of supporting multiple network developers and/or service providers with significant growth potential. By using existing infrastructure, this fiber ring could be installed without the need for costly boring or trenching. One potential routing of the fiber ring is shown in the map on the following page.

One major Phase 4 finding that drives the recommendation is the fact that the City has the ability to rapidly construct a fiber optic ring around Palo Alto, passing through residential areas and all major underground business districts, by co-locating fiber in conduit and on poles with existing Utilities' communications lines. Such a project could be completed at less than a third of the cost competitors would incur to bore underground and install new conduit. This is the City's most significant competitive advantage.

A second major finding was confirmation that telecommunications service providers and network developers are interested in working with the City to gain access to potential Palo Alto customers across a range of options, including leasing dark fiber installed by the Electric Utility. Leasing dark fiber from the Electric Utility would afford service providers and telecommunications network developers with a low cost opportunity to gain direct access to Palo Alto customers, while freeing up some of their scarce network development funds for opportunities in other cities.



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While the City could later choose to develop additional network facilities, the construction of a fiber ring as the network backbone is a necessary first step in the development of all telecommunications networks considered. Such a ring could form the backbone of the independent networks of many telecommunications network developers or could form the backbone of a single network developed exclusively by the City and a partner (if any). The City can defer this decision until after the fiber backbone is constructed. As described in more detail in the City Manager's Report that follows, this approach bears strong similarities with the activities of other California municipal electric utilities including Alameda, Anaheim, Burbank, Colton, Los Angeles and Santa Clara.

If the City Council authorizes the Electric Utility to develop a fiber ring, it will best meet the telecommunications objectives approved by City Council by positioning the City to deliver the maximum community benefits with substantial earnings potential while limiting financial risk.

FISCAL IMPACT[2]

A cost of $1.78 million is estimated for FY 1996-97 to construct the recommended fiber ring and provide for legal counsel, construction management, inspection services, and maintenance equipment. As is typical with construction projects, staff is also requesting contingency funds to account for possible unforseen costs. Because this is staff's first such fiber installation project, in addition to the standard 10% contingency for Electric Utility construction projects, staff is requesting an additional 10% contingency, resulting in a contingency fund of $319,000 for the project. Although unlikely, this contingency fund also covers the possibility that the Electric Utility would need to bore and install new conduit.

The costs related to the staffing for FY 1996-97 that will be requested in a future Budget Amendment Ordinance are estimated at $142,000. The total project costs in FY 1996-97, including the contingency fund, are estimated at $2.24 million.

After the first year, ongoing costs are estimated to be $250,000 per year. This includes the staffing costs, equipment replacement costs, and allocated expenses.

It is recommended that the initial costs be financed with Electric Utility reserves. During and after construction, individual fiber lease agreements will be negotiated with interested telecommunications network developers and service providers and presented to Council for approval. Based on reasonable lease assumptions, costs are expected to be recovered over a 3-5 year period, with mature net cash flows in excess of $1 million per year projected thereafter. The funds used from the Electric Rate Stabilization Reserve to perform the Telecommunications Strategy Study ($106,000 in consultant services and an estimated $88,000 in staff time) and implement the recommended strategy will be repaid out of project revenues.

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[2]All financial data for the recommended strategy are stated in 1996 dollars unless otherwise specified.

ENVIRONMENTAL ASSESSMENT

An environmental review has not been completed at this time. This Council action makes expenditure of funds expressly contingent upon completion of an environmental review.

ATTACHMENTS

1. City Staff. *City of Palo Alto Telecommunications Strategy Study: Phase 4 Report, Volume 1.* June 19, 1996.

2. City Staff. *City of Palo Alto Telecommunications Strategy Study: Phase 4 Report, Volume 2 - Appendices.* June 19, 1996.

3. Budget Amendment Ordinance.

4. Amendment to the City's *1996-1997 Adopted Budget.*

5. June 25, 1996 Memorandum to the Utilities Advisory Commission.

6. Minutes of all UAC discussions of Phases 1-4 of the Telecommunications Strategy Study. June 25, 1996 (Phase 4) and January 10, 1996 (Phases 1-3).

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SUBJECT: **Telecommunications Strategy Study -- Phase 4 Results and Recommendations**

RECOMMENDATIONS

This report recommends that the City Council:

1.) Approve a Budget Amendment Ordinance requesting the use of $2,061,600 from the Electric Rate Stabilization Reserve to fund a positioning strategy involving Electric Utility development of a dark fiber ring to be co-located in conduit and on poles with existing Utilities' communications lines.

2.) Approve keeping the commercial telecommunications assets separate from the Electric Fund rate base upon which General Fund transfers are calculated.

3.) Convert Phase 5 of the Telecommunication Strategy Study from business plan development to strategy implementation.

Prior to unanimous endorsement by the Utilities Advisory Commission, the Telecommunication Advisory Panel (TAP), formed at the start of the project, reviewed the Phase 4 report and provided feedback to staff. Six of the seven TAP members attended a meeting to discuss the Phase 4 report and unanimously endorsed the recommended strategy.

BACKGROUND

On May 8, 1995, the City Council approved a Budget Amendment Ordinance to use $135,100 from the Electric Rate Stabilization Reserve to fund the five-phase study to develop a telecommunications strategy for the City (CMR:240:95). The selected consultant, The ICT Group, completed Phases 1-3 of the study at a cost of $91,000. As a part of Phase 3, staff also prepared a supplemental report to further examine a class of strategies described as "Leased Access" strategies. The results of Phases 1-3 were presented to the City Council on February 26, 1996 (CMR:150:96). At that meeting, Council approved a recommendation to have staff assume responsibility for Phase 4 of the study with limited technical assistance provided by one or more consultants.

Following the issuance of a Request for Proposals, staff selected the Media Connections Group (MCG) to provide technical support for staff during Phase 4 of the study. Of the $33,000 originally budgeted in May 1995 for Phase 4, $15,000 were used for MCG's consultant services.

MCG provided key insights and input data used by staff to model alternative strategies. MCG also critically reviewed staff's evaluation and Phase 4 report.

POLICY IMPLICATIONS

The recommended positioning strategy involving Electric Utility development of a dark fiber optic ring would be an extension of the City's long-standing policy of providing utilities infrastructure for the citizens and businesses of Palo Alto. Implementing the strategy would leverage existing Electric Utility infrastructure to initiate the City's involvement in providing telecommunications infrastructure.

Expenses for the study to date have been taken from the Electric Rate Stabilization Reserve. Most of the implementation costs are also proposed to be funded by the Electric Rate Stabilization Reserve as described in the proposed Budget Amendment Ordinance included as Attachment 3. The proposed telecommunications program will be a subfund of the Electric Fund and will appear as a new Functional Area in the Electric Fund. When a positive cash flow is realized, staff will review revenue projections and ongoing funding needs and recommend a period over which repayment of the Electric Rate Stabilization Reserve should occur.

The changes to the *1996-1997 Adopted Budget* that would occur as result of implementing this strategy are presented in Attachment 4. Additionally, in a future Budget Amendment Ordinance that will be presented to Council, one staff position will be requested for FY 1996-97 to assume general responsibility for the City's commercial telecommunications activities. It is further anticipated that a second staff position may be requested in FY 1997-98 to maintain the system.

Staff is recommending that the telecommunications asset base be kept separate from the electric distribution system asset base and not used to determine the transfer to the General Fund. This differs from the City's long-standing General Fund transfer policy for existing utilities involving an equity transfer that is based upon the risk that was initially imposed upon the General Fund when these utilities were created. For the proposed telecommunications activities, no such risk would be taken by the General Fund. Instead, the risk would be borne by the Electric Utility with the belief that the risk is limited and that the recommended strategy will diversify the Electric Utility's revenue streams into a growth market and better position the Electric Utility for impending competition in the electric utility industry. For this reason, staff believes that including the telecommunications assets as a part of the Electric Fund rate base upon which General Fund transfers are calculated would not be appropriate.

The Electric Utility's involvement in telecommunications would initially be limited in nature, but could later be expanded if deemed appropriate. While the recommended strategy involves limited financial commitment, it has the potential to deliver substantial benefits to the Palo Alto community. The recommended strategy was identified as the City telecommunications strategy that best achieves the telecommunications objectives approved by the City Council on February 26, 1996 (as described in the Discussion section of the City Manager's Report that follows).

Additionally, in response to the passage of the Telecommunications Act of 1996, staff is developing policy guidelines for the use of the public rights of way for telecommunications infrastructure development. Staff will report back to the City Council after these guidelines have been drafted.

DISCUSSION

The overall goal of the Telecommunications Strategy Study is to identify the best City strategy for accelerating the pace at which high-quality, low-cost, advanced telecommunications services are delivered throughout Palo Alto while limiting any negative impacts on Palo Alto's physical environment. The first three phases explored what the City is best positioned to do, estimated the size and nature of the Palo Alto telecommunications market, and narrowed the field of potential City telecommunications strategies down to the two most attractive strategies:

- ***Lease Existing Infrastructure*** - The City actively leases spare conduit and pole space to private telecommunications network developers and/or companies in Palo Alto interested in establishing point-to-point telecommunications links.

- ***Develop a Network and Lease Access*** - The City develops a new telecommunications network, independently or with one or more partners, and leases access to all interested services providers.

The Phase 4 evaluation process consisted of:

- An assessment of the City's strengths and weaknesses relative to competitors.

- Meetings with telecommunications managers from Palo Alto corporations, representatives from the Palo Alto Unified School District, and PA-COMNET.

- Issuance of a Request for Information to telecommunications service providers. Preliminary discussions with representatives from AT&T, Brooks Fiber Communications, Cable Co-op, ICG Access, Pacific Bell, SpectraNet International, and the Teleport Communications Group.

- Qualitative evaluation of a range of potential telecommunications strategy variations.

- Quantitative evaluation of specific telecommunications strategy implementations.

One major finding in Phase 4 was that the City has the ability to rapidly construct a fiber optic ring around Palo Alto, passing through residential areas and all major underground business districts, by co-locating fiber in conduit and on poles with existing Utilities' communications lines. Such a project could be completed at less than a third of the cost competitors would incur to bore underground and install new conduit. This is the City's most significant competitive advantage.

A second major finding was confirmation that telecommunications service providers and network developers are interested in working with the City to gain access to potential Palo Alto customers across a range of options, including leasing dark fiber installed by the Electric Utility. Leasing dark fiber from the Electric Utility would afford service providers and telecommunications network developers with a low cost opportunity to gain direct access to Palo Alto customers, while freeing up some of their scarce network development funds for opportunities in other cities.

While the City could later choose to develop additional network facilities, the construction of a fiber ring as the network backbone is a necessary first step in the development of all telecommunications networks considered. Such a ring could form the backbone of the independent networks of many telecommunications network developers or could form the backbone of a single network developed exclusively by the City and a partner (if any). The City can defer this decision until after the fiber backbone is constructed.

Achievement of City Telecommunications Objectives

If the City has the Electric Utility develop a fiber ring, it will best meet the telecommunications objectives approved by City Council by positioning the City to deliver the maximum community benefits with substantial earnings potential while limiting financial risk. The manner in which the recommended strategy achieves each of these telecommunications objectives is described below:

- ***Accelerated deployment of a broad range of advanced broadband telecommunications services to all of the citizens and businesses in Palo Alto.***

  Fiber optic infrastructure will be a necessary element of networks capable of delivering advanced, two-way broadband telecommunications services. The recommended strategy involves the Electric Utility deploying enough fibers to facilitate the cost-effective delivery of such services to all of the residents and businesses of Palo Alto.

- ***Decreased costs for both conventional and advanced telecommunications services (as compared to the costs for similar services if provided without City involvement).***

  By co-locating fiber with existing Utilities' communications lines, the Electric Utility has the ability to install a 15-mile fiber ring around Palo Alto that is roughly 70% underground -- without the need for expensive boring or trenching in underground districts. Given that the cost of directional boring and installing new conduit is estimated at $20/foot (over $100,000 per mile), this presents an opportunity for a corresponding savings to end users.

- ***High quality for both conventional and advanced telecommunications services.***

  Fiber optic cable is the most reliable and error-free telecommunications media available. When deployed in a route-diverse[3] ring with signals sent both clockwise and counterclockwise around the ring, even a cut through the fiber cable (e.g., from a backhoe) will not interrupt the transmission of a signal sent between any two points on the ring. By installing fiber optic cable in a route-diverse ring, the City will ensure that a backbone is available that is capable of delivering the highest quality and most reliable telecommunications service possible.

- ***Enhanced competition among telecommunications service providers and increased telecommunications choices for consumers (who are currently limited to monopoly service providers for telephone and cable television service).***

  By installing a fiber optic ring with a high fiber count, the City will have the ability to promote competition by leasing individual fibers to a number of service providers. By reducing the barrier to entry associated with the cost of developing new infrastructure, more companies will be able to avoid a significant portion of those costs and economically provide competitive telecommunications services in Palo Alto. This will have the effect of increasing choices for consumers while minimizing disruption to the public rights of way.

- ***Limited or no financial risk exposure to the City.***

  With a construction cost under $2.0 million to be funded with Electric Utility reserves, risk exposure is limited to a manageable level. It is anticipated that lease revenues would recover the construction costs and the associated staffing and other costs within a 3-5 year period. Furthermore, in the unlikely event that the Electric Utility is unable to secure sufficient lease revenues, the fiber ring will be a valuable asset that could be sold at a price likely to exceed the construction cost due to the value added by the use of the Electric Utility's existing conduit.

Community Benefits of the Recommended Strategy

As described above, the benefits of the recommended strategy range from reduced costs for existing telecommunications services to accelerated access to a variety of new telecommunications services. By reducing the cost of market entry by using existing Electric Utility assets and sharing the cost of infrastructure development over multiple network

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[3]For a fiber ring to be route-diverse, the fiber must not pass by a given location more than one time in a single pass around the ring. For example, a fiber cable in the shape of a "figure eight" would not be route-diverse because the fiber cable must cross over itself at the center point of the "figure eight". In such a non-route-diverse fiber ring, a single cut could split the fiber cable into two separate segments, preventing information from traveling from one segment to the other.

developers and/or service providers, the City will promote competition where it has not previously existed. In order to secure and maintain market share, competitors will need to offer high quality, advanced services at low costs -- to the direct benefit of the Palo Alto community. The likely benefits to specific segments of the Palo Alto community are summarized below:

Residents - Palo Alto residents are among the most sophisticated and demanding users of telecommunications in the nation yet do not have access to infrastructure that is capable of supporting their demand. Neither Cable Co-op nor Pacific Bell have residential infrastructure involving fiber optic cabling, yet both agree that a fiber upgrade is necessary to provide advanced services demanded by many residents today. Fiber deployed by the Electric Utility in the near-term could be used as a backbone of a future upgrade to existing infrastructure or of newly developed infrastructure capable of supporting a variety of advanced services, including telecommuting and Internet access at speeds 100 times faster than what is available today.

In general, advanced infrastructure promises to enable much greater amounts of information to be sent to and from each household in Palo Alto on an interactive basis. Television signals currently transmit large quantities of information, but all viewers are restricted to *receiving* video information (television programs) selected by the programmers according to a single schedule. A connection to the Internet via a telephone line allows the user to *transmit or receive* selected information at the user's convenience. The primary limitation of such an Internet connection, however, is the frustrating amount of time it takes to transmit or send large quantities of information, particularly graphical information. Just as television would be frustrating if the viewer had to wait for a minute or more for a clear picture to arrive after turning a channel, the Internet is still a frustrating medium due to the amount of time it takes to send and receive graphical information. The solution is higher speed access, of which the proposed fiber ring could be a fundamental part.

Exciting applications that will become commonplace once high speed Internet access is available are already being demonstrated and more sophisticated ones will certainly follow. Using these applications, residents will obtain the capability to do a variety of things from their home. For example:

- Friends and relatives will stay in touch electronically, sharing digital copies of photographs and home videos.

- Students will access the vast resources of the world's virtual library, including text and still pictures as well as interactive demonstrations of concepts, without having to leave home.

- Travel plans will be arranged using electronic travel agents that search out the lowest cost and/or most convenient options available. Maps will be instantly accessible over a range of levels of detail and content.

- Real time stock prices will be monitored and stocks will be bought and sold via low cost electronic brokers.

- Prospective home buyers will pre-screen homes on the market without wasting time and disturbing home owners by taking virtual walks through homes via video files available electronically.

- Residents will find it easier to participate in city, state, and federal governing processes through improved access to information on topics of interest and improved means for communicating with governing bodies.

Although the proposed fiber ring does not by itself provide these capabilities, it does represent a fundamental part of the infrastructure necessary to support them. As such, it is a significant step toward accelerating the pace at which these capabilities are available for residents. The proposed telecommunications strategy was publicly supported by PA-COMNET[4] at the June 25 UAC meeting.

Businesses - Palo Alto is the site of the corporate headquarters or major R&D facilities for many large corporation with a strong need for access to the most advanced telecommunications services available. Palo Alto also has been characterized as having the highest concentration of Internet-related businesses of any city in the nation. While large corporations in Palo Alto are currently served with direct fiber connections, the cost of service is high. The recommended strategy would attract competition, driving down prices and making direct fiber connections accessible to a larger number of businesses. As with the low cost, high quality Electric Utility service, this would be a strong force for business attraction and retention. Additionally, some large corporations in Palo Alto have active telecommuting programs that would benefit from enhanced telecommunications access for those employees that live in Palo Alto.

Medical Institutions - Palo Alto's hospitals and other medical and dental facilities would benefit from the ability to transmit graphical medical information (e.g., X-rays) between locations within Palo Alto and around the world. Such information sharing would enable more effective and efficient diagnosis and treatment. Telemedicine techniques are emerging as a means of expanding the reach of the expertise of specialists without regard for geographic constraints.

Schools - The Palo Alto Unified School District has approached the City to express their interest in developing a fiber optic network connecting their 16 schools with their District Office and the site of a private corporation where they would access the Internet. Assuming acceptable terms could be negotiated, fibers in the proposed ring could be used as the backbone of a PAUSD

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[4]PA-COMNET is a voluntary group consisting largely of residents and members of the local business community with a vision for enhancing Palo Alto's sense of community by using telecommunications technology to bring people together for the exchange of ideas.

network. Such a network would facilitate information sharing between schools and high speed access to the Internet. Stanford University would also benefit from improved access to telecommunications carriers with facilities in Palo Alto.

City Departments - While existing City telecommunications facilities adequately meet the City's current needs, within 5-10 years, reliability and bandwidth constraints will require the City to upgrade its telecommunications facilities to an internal fiber optic-based network. The recommended strategy would reserve fibers for such a network which could be used for a variety of applications, including replacement of the Electric Utility's substation protection system (originally installed in 1969), library interconnection, video traffic detection, transparent access from the MSC to the Geographic Information System (GIS) located in City Hall, and direct access to long distance telephone companies and Internet access providers. The avoided cost of the Electric Utility developing a fiber ring that would be limited to internal uses is estimated to be $190,000.

Comparison to Other California Municipal Electric Utilities

The recommended strategy is very similar to strategies being implemented at a number of municipal electric utilities across the nation, including the following six California utilities:

Alameda (pop. 80,000) - The Alameda Bureau of Electricity has been authorized by their City Council to install 5 miles of dark fiber in existing conduits and on existing poles to form a series of three fiber rings. Installation is targeted for completion by the end of August. An agreement is being negotiated with ICG Access for a lease involving less than 10% of the fibers that would enable complete capital cost recovery within 6 years.

Anaheim (pop. 282,000) - Anaheim's electric utility has installed a 30-mile fiber ring to interconnect electric substations (including electronics) that became operational in July 1996. An additional 20-mile fiber ring is currently under construction and should be operational by November 1996. Anaheim is in a due diligence phase of negotiations with SpectraNet International for a partnership that would use surplus fibers as the backbone of a network that would be developed to serve Anaheim's businesses and residents. They hope to have a final agreement in place by November 1996.

Burbank (pop. 100,000) - Burbank's electric utility is installing a 20-mile fiber backbone to meet electric utility and city government telecommunications needs, with additional bandwidth and/or fibers planned for lease to meet the needs of Burbank's entertainment industry and other large business customers.

Colton (pop. 45,000) - Colton's electric utility has installed a 5 mile fiber ring to connect electric utility substations that will be operational in about one month. An additional 5 miles of fiber extensions will be added to interconnect other city facilities to the ring. Surplus fibers have been installed for future expansion.

Los Angeles (LADWP) (pop. 3,449,000) - The Los Angeles Department of Water and Power first started installing fiber for internal needs in 1989 and currently has over 120 miles of fiber rings in place with plans to expand to 240 miles in the near future. LADWP has been aggressively leasing dark fiber for about 18 months and currently has 9 lease agreements with 5 companies for roughly 1400 fiber-miles at lease rates ranging from $900-$1400 / fiber-mile per year. The City of Los Angeles is also planning to issue a Request for Proposals for a partnership with telecommunications network developer that would develop a network throughout Los Angeles.

Santa Clara (pop. 95,000) - Santa Clara's electric utility is designing a 30-mile fiber backbone to meet electric utility and other city government telecommunications needs, with surplus fiber capacity reserved for future enterprise development. Outside plant construction is expected to begin in November 1996 and take four to five months to complete.

Conclusions

By implementing the recommended strategy, the City would focus its telecommunications activities directly on its key competitive advantage: the Electric Utility's ability to rapidly construct a route-diverse fiber ring without incurring the high cost of boring underground and installing new conduit. By independently developing the ring, the Electric Utility will maintain exclusive control over its infrastructure and situate itself in a flexible position of strength from which to utilize the fiber to the greatest benefit of the Palo Alto community. With a construction cost under $2.0 million, but with a resale value believed to be considerably higher, the construction of a fiber ring would be a conservative step forward. However, although conservative, it would position the City to deliver tremendous benefits to the community while generating additional revenues for the Electric Utility.

ALTERNATIVES

If the City's sole objective is to minimize financial risk to the exclusion of other stated objectives, it could instead lease existing infrastructure to a single telecommunications network developer. However, this would limit the Electric Utility's earnings potential and result in the Electric Utility relinquishing control of infrastructure to a private company interested in limiting competition in Palo Alto. In so doing, the City would forego the opportunity to deliver the community benefits associated with a truly competitive telecommunications marketplace.

The City could also choose to pursue a more aggressive strategy involving additional network development. At this time, however, it is not necessary for the City to make such a decision. As such, it would be prudent for staff to continue to gather additional information and for the UAC and Council to defer consideration until after the fiber ring is developed. With the recommended strategy, the City would be positioned to lease dark fibers or to develop additional network facilities if later determined to be appropriate.

Attachments 1 and 2 thoroughly document the evaluation of alternative strategies.

FISCAL IMPACT

A cost of $1.78 million is estimated for FY 1996-97 to construct the recommended fiber ring and provide for legal counsel, construction management, inspection services, and maintenance equipment. As is typical with construction projects, staff is also requesting contingency funds to account for possible unforseen costs. Because this is staff's first such fiber installation project, in addition to the standard 10% contingency for Electric Utility construction projects, staff is requesting an additional 10% contingency, resulting in a contingency fund of $319,000 for the project. Although unlikely, this contingency fund also covers the possibility that the Electric Utility would need to bore and install new conduit. An itemization of costs is presented in the table below.

ITEMIZATION OF COSTS IN THE PROPOSED BUDGET FOR FY 1996-97

Cost Item	Funded from Electric Reserves	Reallocated within Electric Utility	Total Funding Requirement
Fiber Cable Costs	$1,370,000		$1,370,000
Design & Installation Costs	$138,000		$138,000
Construction Management	$85,000		$85,000
Maintenance Equipment	$50,000		$50,000
Salaries & Benefits			
Resource Planner		$26,400	$26,400
Temporary Inspection Services	$25,000		$25,000
Training	$10,000		
Outside Legal Counsel	$50,000		$50,000
Consultant Services	$15,000		$15,000
Allocated Expenses		$9,000	$9,000
Subtotal	$1,743,000	$35,400	$1,768,400
Construction Contingency	$318,600		$318,600
Total	$2,061,600	$35,400	$2,087,000

The costs related to the staffing for FY 1996-97 that will be requested in a future Budget Amendment Ordinance are estimated at $142,000. The total project costs in FY 1996-97, including the contingency fund, are estimated at $2.24 million.

After the first year, ongoing costs are estimated to be $250,000 per year. This includes staffing costs, equipment replacement costs, and allocated expenses.

It is recommended that the initial costs be financed with Electric Utility reserves. During and after construction, individual fiber lease agreements will be negotiated with interested telecommunications network developers and service providers and presented to Council for approval. Based on reasonable lease assumptions, costs are expected to be recovered over a 3-5

year period, with mature net cash flows in excess of $1 million per year projected thereafter. The funds used from the Electric Rate Stabilization Reserve to perform the Telecommunications Strategy Study ($106,000 in consultant services and an estimated $88,000 in staff time) and implement the recommended strategy will be repaid out of project revenues.

ENVIRONMENTAL ASSESSMENT

An environmental review has not been completed at this time. This Council action makes expenditure of funds expressly contingent upon completion of an environmental review.

STEPS FOLLOWING APPROVAL

Following City Council approval of the recommended strategy, staff will proceed with implementing the strategy as Phase 5 of the Telecommunications Strategy Study. This will involve an environmental review, the design and construction of the fiber ring, and additional discussions with telecommunications service providers and telecommunications managers from Palo Alto businesses. These discussions should provide information that will help staff determine the number of fibers to include in the fiber ring and evaluate additional network development opportunities.

Additionally, the City Attorney will retain outside legal counsel to address any legal issues associated with implementing the recommended strategy.

City of Palo Alto
TELECOMMUNICATIONS STRATEGY STUDY

PHASE 4 REPORT
Volume 1

June 19, 1996

Prepared by Staff

City of Palo Alto
Telecommunications Strategy Study
PHASE 4 REPORT
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Volume 2 - Appendices

1. EXECUTIVE SUMMARY

In May 1995, the City of Palo Alto initiated the five-phase Telecommunications Strategy Study to identify the best City strategy for accelerating the pace at which high-quality, low-cost, advanced telecommunications services are delivered to the residents and businesses of Palo Alto while limiting any negative impacts on Palo Alto's physical environment. The first three phases explored what the City is best positioned to do, estimated the size and nature of the Palo Alto telecommunications market, and narrowed the field of potential City telecommunications strategies down to the two most attractive strategies:

- ***Lease Existing Infrastructure*** - The City actively leases spare conduit and pole space to private telecommunications network developers and/or companies in Palo Alto interested in establishing point-to-point telecommunications links.

- ***Develop a Network and Lease Access*** - The City develops a new telecommunications network, independently or with one or more partners, and leases access to all interested services providers.

This report presents the detailed evaluation of specific implementations of these two strategies that was completed in Phase 4 of the City's Telecommunications Strategy Study. The evaluation process consisted of:

- An assessment of the City's strengths and weaknesses relative to competitors.

- Meetings with telecommunications managers from Palo Alto corporations, representatives from the Palo Alto Unified School District, and PA-COMNET.

- Issuance of a Request for Information to telecommunications service providers. Preliminary discussions with representatives from AT&T, Brooks Fiber Communications, Cable Co-op, ICG Access, Pacific Bell, SpectraNet International, and the Teleport Communications Group.

- Qualitative evaluation of a range of potential telecommunications strategy variations.

- Quantitative evaluation of specific telecommunications strategy implementations.

The key findings of this Phase 4 report are:

- The City's key competitive advantage is its ability to rapidly construct a fiber optic ring around Palo Alto, passing through residential areas and all major underground business districts, by co-locating fiber in conduit and on poles with existing Utilities' communications lines. Such a project could be completed at less than a third of the cost competitors would incur to bore underground and install new conduit.

- Telecommunications service providers and network developers have expressed an interest in working with the City to gain access to potential Palo Alto customers by leasing either existing conduit and poles or new telecommunications facilities developed by the City.

- The City has a variety of telecommunications network development options from which to choose; however, all of them involve the construction of a fiber backbone ("Strategy B") as a necessary first step. The City can defer deciding whether or not to add additional telecommunications facilities necessary for a functional network until after the fiber backbone is constructed. If the City develops a fiber ring, it will best meet the objectives approved by City Council by positioning the City to deliver the maximum community benefits with substantial earnings potential while limiting financial risk.

- If the City's sole objective is to minimize financial risk to the exclusion of other stated objectives, it could instead lease existing infrastructure to a single telecommunications network developer ("Strategy A"). However, this would limit the City's earnings potential and result in the City relinquishing control of infrastructure to a private company interested in keeping competition out of Palo Alto. In so doing, the City would forego the opportunity to deliver the community benefits associated with a truly competitive telecommunications marketplace.

Recommendation[1]

Based on these findings, staff recommends that the Electric Utility construct a fiber backbone ("Strategy B") at an estimated cost of $1.51 million. Additional costs of $350,000 are estimated during FY 96-97 for legal counsel, construction oversight and inspection, maintenance equipment, and the addition of one Full Time Equivalent staff position to manage telecommunications activities. After the first year, ongoing costs are estimated to be $210,000 per year. It is recommended that the initial costs be financed with Electric Utility reserves. These costs are expected to be recovered over a 3-5 year period, with mature net cash flows in excess of $1 million per year projected thereafter. (See Appendix D for financial model details.)

[1]All financial data for the recommended strategy are stated in 1996 dollars.

2. INTRODUCTION AND MOTIVATION

The City of Palo Alto is in a unique position to provide a benefit to the residents and businesses of Palo Alto by actively promoting the use of existing Utilities infrastructure for the development of telecommunications facilities. As was concluded in Phase 3 of this five-phase study, the City has no interest in directly providing telecommunications services at this time. For this reason, the City is a competitively neutral party that could provide an infrastructure platform upon which multiple parties could competitively provide telecommunications services to Palo Alto residents and businesses. In so doing, the City would also stand to benefit from access to enhanced telecommunications capabilities for internal uses.

To clarify the City's purpose in contemplating some level of involvement in telecommunications, five objectives were specified. If the City is able to achieve these telecommunications objectives, the Palo Alto community would benefit in a number of ways, as described below for each City telecommunications objective.

1. ***Accelerated deployment of a broad range of advanced broadband telecommunications services to all of the citizens and businesses in Palo Alto.***

   Since large businesses in Palo Alto are already gaining access to advanced broadband telecommunications facilities, residents and small businesses would stand to benefit most if the City would achieve its objective of accelerating the deployment of advanced broadband telecommunications throughout Palo Alto. Although Palo Alto's small businesses and residents are among the most advanced telecommunications users in their customer classes, their access to telecommunications facilities and services is currently limited to a level that does not reflect their demand. By actively promoting the use of existing Utilities' assets, the City has the opportunity to encourage private telecommunications service providers to accelerate the rate at which they meet this demand.

2. ***Decreased costs for both conventional and advanced telecommunications services (as compared to the costs for similar services if provided without City involvement).***

   The City has a real opportunity to leverage existing Utilities' infrastructure to help minimize the cost of developing telecommunications infrastructure in Palo Alto. All of the users of telecommunications services in Palo Alto, whether residents or major corporations, would benefit if the City is successful in reducing telecommunications service costs. In addition to the obvious benefits of reduced costs, reductions in the cost of advanced telecommunications services, such as high speed data services, would encourage a larger population of users to enjoy the benefits of these emerging services. The increase in the population of users in turn would make the advanced telecommunications services more valuable. This would further stimulate demand and drive down prices.

3. ***High quality for both conventional and advanced telecommunications services.***

   By achieving this objective, the City will help ensure that Palo Alto residents and businesses have access to the highest quality telecommunications services available. Such quality is necessary for Palo Alto's businesses to remain at the leading edge of their respective industries and would allow residents to enhance both the personal and professional aspects of their lives.

4. ***Enhanced competition among telecommunications service providers and increased telecommunications choices for consumers (who are currently limited to monopoly service providers for telephone and cable television service).***

   Even though the Telecommunications Act of 1996 will allow competition that was previously prohibited by law, the extent to which competition will actually emerge in Palo Alto is still uncertain. The cost of developing new infrastructure throughout Palo Alto is a significant barrier to entry that could prevent a truly competitive telecommunications marketplace from forming. With City involvement, this barrier could be reduced. If successful in enhancing competition, Palo Alto's consumers would likely benefit from access to a broader range of services at lower prices than would otherwise be available.

5. ***Limited or no financial risk exposure to the City.***

   The City represents everyone in Palo Alto and has a responsibility to act prudently on all fiscal matters. The Electric Utility reserve is one potential source of funding for City telecommunications activities. An Electric Utility investment in telecommunications infrastructure would benefit the Electric Utility by diversifying its investment portfolio and providing the potential for improved utility operations (see Section 4.3), but would put at risk funds that may be needed to help the Electric Utility respond to competitive threats. By limiting exposure to financial risk, the Electric Utility could enhance, rather than restrain, its ability to thrive in a competitive electric utility industry.

3. ASSESSMENT OF THE CITY'S COMPETITIVE POSITION

The City has a number of strengths that could lead to competitive advantages in telecommunications; however, the City also has a number of weaknesses relative to potential competitors. These strengths and weaknesses were briefly discussed in Phase 1 of the study. This section expands on that discussion.

3.1. Strengths

Physical Assets

The City of Palo Alto has a number of physical assets that would be of use in the development of telecommunications facilities in Palo Alto.

1. **Poles and Conduit** - The Electric Utility has an extensive system of poles and conduit that are used to distribute electricity to every business and resident in Palo Alto. Poles and conduit are also used by the Electric Utility to provide internal City telecommunications via a coaxial cable system (similar to the infrastructure used in traditional cable television networks) and via three separate twisted pair systems (similar to the infrastructure used in traditional telephone networks). The Electric Utility's facilities are typically located on poles and in conduits located in trenches that are shared with Pacific Bell and Cable Co-op. Typical arrangements of cables on poles and in conduits are shown in Figures 1a and 1b; however, the number and type of the cables vary significantly according to the needs of each area.

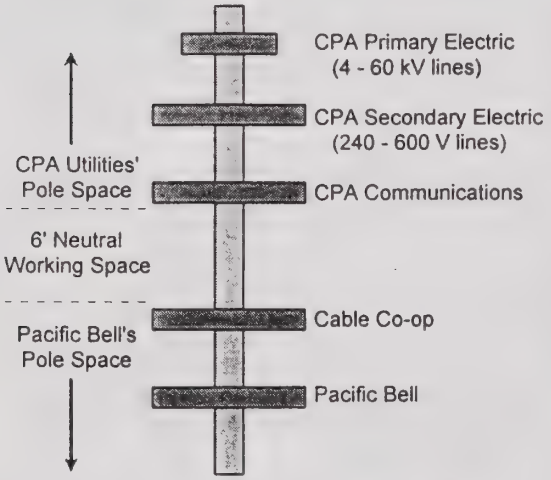

Figure 1a - Typical Pole Attachments

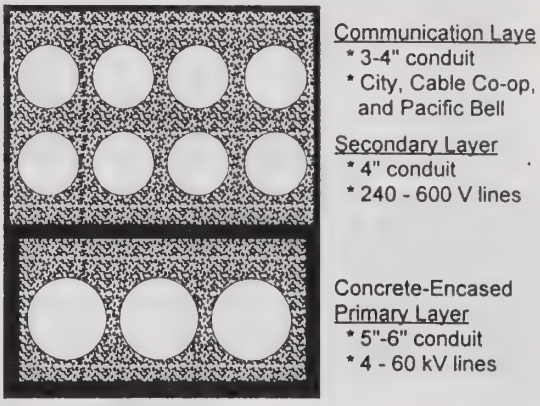

Figure 1b - Typical Trench Cross-Section

On jointly-owned poles, the Electric Utility owns the top portion, Pacific Bell owns the lower portion, and a six foot neutral working space is provided in between the two. Cable Co-op's cables occupy space in Pacific Bell's portion of the pole. The number of each type of conduit varies across the city, but the primary conduits (containing 4,000 - 60,000 volt lines) are always located in a concrete-encased layer below the layer containing secondary electric (240 - 600 volt lines) and communications conduits owned by the Electric Utility, Pacific Bell, and Cable Co-op.

The three main trunks of the Electric Utility's coaxial cable system extend through much of Palo Alto, including all major business districts, as shown in Figure 2. Coaxial cable branches also extend off of the main trunks to additional City facilities including all 89 traffic lights on Palo Alto's City streets. In the areas of town that have been undergrounded, this cable is located in 3" or larger conduits, leaving ample room for installation of fiber optic cable(s). Combined with the routing of the Electric Utility's existing twisted pair communications system, a complete fiber ring can be co-located with existing Electric Utility communications facilities, eliminating the need for boring under, or trenching in, City streets for this portion of a network.

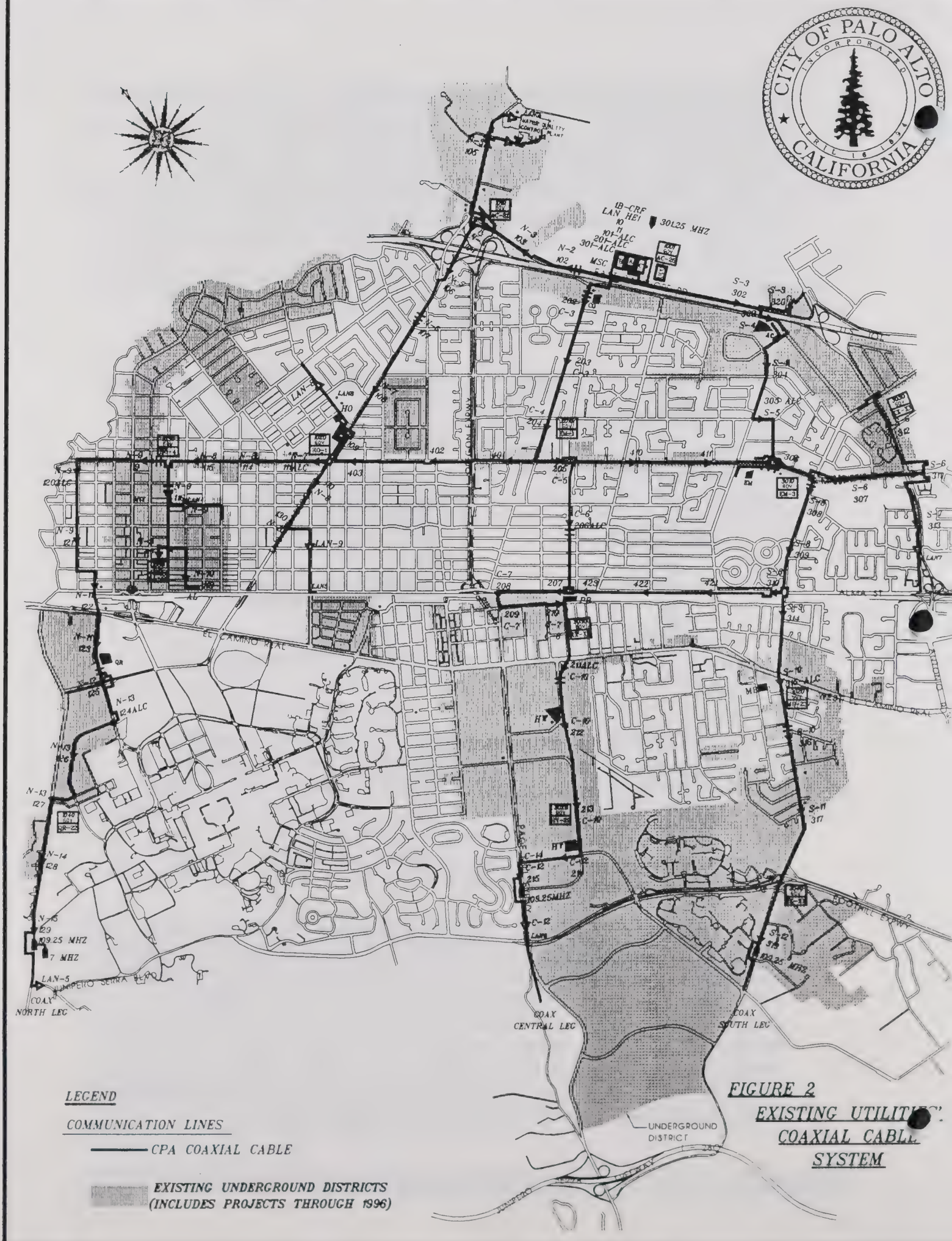

FIGURE 2
EXISTING UTILITIES' COAXIAL CABLE SYSTEM

Such co-location of fiber would enable a rapid, low-cost buildout of a 15 mile ring around Palo Alto (with an estimated 70% of the fiber underground). One potential routing for such a ring is shown in Figure 3. Given that the cost of boring under City streets is roughly $20/foot ($100,000/mile), the Electric Utility's poles and conduit represent a substantial asset. Using existing Utilities infrastructure, a fiber backbone comparable to the one developed by Metropolitan Fiber Systems in 1994 (not including fiber laterals to customer premises or electronics) could be constructed at less than a third of the cost.

Experience has demonstrated that fiber optic cables have useful lives exceeding 30 years. Fiber also does not face the bandwidth constraints of coaxial cable systems. By upgrading electronics, the capacity of a given strand of fiber can also be increased almost indefinitely to match demand as it increases in the future. For these reasons, fiber is being widely deployed as the ideal backbone for future-proof telecommunications networks.

2. **Municipal Service Center** - The Utilities' Municipal Service Center (MSC) represents a secure location with potential space for storing equipment, spare cable and components, and vehicles necessary to operate a telecommunications network. Given the scarcity and high cost of real estate in Palo Alto, this is a significant asset. For this asset to be useful for an organization other than the City (i.e., a partner or a service provider), however, Utilities would need to resolve questions regarding security, location of facilities, and conditions of use and access.

3. **Extensive City Facilities** - A telecommunications network requires distributed electronics and powering equipment, some of which must be protected from the environment and located inside of buildings. With ten electric utility substations, eight fire stations, six libraries, and numerous community centers and other facilities, the City has more facilities distributed throughout Palo Alto than any other organization. As with the MSC, for these other facilities to be used by an organization other than the City (i.e., a partner or a service provider), the City would need to resolve questions regarding security, location of facilities, and conditions of use and access.

4. **Equipment** - The Utilities Department has equipment that could be used to assist in developing telecommunications facilities. Such equipment includes equipment needed to pull cable through conduits, install cable on poles, dig trenches, and horizontally bore over limited distances.

5. **Mapping / GIS Equipment** - Mapping is an essential part of the development and maintenance of infrastructure of the complexity necessary for a telecommunications network. The City's Geographic Information System (GIS) is a sophisticated tool that can be used to inventory available pole and conduit space and to help create and update network facilities designs.

6. **Billing System Databases** - Both the current Utilities billing system and the new system under development are limited in their ability to provide detailed billing statements to

FIGURE 3

POTENTIAL ROUTING FOR FIBER RING CO-LOCATED WITH EXISTING UTILITES' COMMUNICATION LINES

customers that are necessary for telecommunications services. The current billing system's database of customers, however, could be useful for establishing a database of telecommunications customer accounts. Monthly Utilities bill statements are also an excellent marketing vehicle that represent a monthly point of contact with every business and resident in Palo Alto.

Core Competencies

In addition to physical assets, City staff have skills that would be of use in developing and operating a telecommunications enterprise.

1. **Cable Infrastructure Development** - City staff have significant experience with the development of both overhead and underground cable infrastructure for electric distribution and internal communications over coaxial and twisted pair cables. The City has little experience installing fiber optic cable; however, a limited amount of training could prepare existing City staff with the necessary installation skills. This has been demonstrated at other municipal electric utilities such as those in Burbank, CA and Cedar Falls, IA.

2. **Siting Equipment in Palo Alto** - Through experience with siting equipment such as pad-mounted transformers, Utilities staff have as much experience as any entity in meeting the stringent siting requirements established by the City. This experience would help expedite the development of a telecommunications network that meets City guidelines.

3. **Market Intelligence** - Although competition has only recently emerged in the electric and gas utility industries, Utilities staff are demonstrating an astute ability to understand and meet customer needs. Existing relationships with customers are strong and should be valuable in marketing telecommunications services.

4. **Cost-Based Operation** - Throughout its history, the City has operated very successful Utilities with cost-based rates that are consistently lower than their counterparts in the private sector. With telecommunications, the City should also be able to keep rates competitive by establishing rates with smaller returns than those demanded by private competitors.

3.2. Weaknesses

Given that the City has no experience providing commercial telecommunications services, it is not surprising that the City has a number of weaknesses relative to companies with many years of such experience. The City has recognized this and is not considering strategies involving the delivery of telecommunications services to end users. As a result, these weaknesses are not as significant for the strategies being considered, but are still significant for strategies involving the development of new telecommunications facilities. For such strategies, some weaknesses could be easily overcome with the selection of an appropriate partner; others would be more challenging.

1. **Lack of Experience** - Although the City has significant experience operating telecommunications equipment to interconnect City facilities, the City has no experience in providing such services commercially. To be successful, in particular with the business market, service reliability is critical. Telecommunications services must be available 24 hours per day, 7 days per week, 365 days per year. Without a demonstrated track record in providing telecommunications services, it would be difficult to convince customers that the City can provide the necessary level of reliability and service quality. Service providers and/or a partner should be able to compensate for this weakness.

2. **New Entrant** - The City will be a new entrant attempting to secure market share from incumbent telecommunications infrastructure providers (e.g., Pacific Bell, Metropolitan Fiber Systems, and Cable Co-op). City infrastructure must be highly reliable and priced below that of incumbent infrastructure providers in order to convince telecommunications service providers to use it to gain access to Palo Alto end users.

3. **Limited Geographic Scope** - A telecommunications network that extends throughout Palo Alto is of very limited value unless it is connected to the outside world. A competitor such as Pacific Bell is at a competitive advantage because a significant amount of their Palo Alto customer traffic terminates outside of Palo Alto, but within the boundaries of their network, enabling them to handle the traffic internally. This is a problem for most service providers as well. Additionally, given Palo Alto's relatively small market size, the City will not be able to take advantage of the economies of scale of larger competitors.

4. **No Profit Motive** - As a public entity, the City does not have a profit motive. This limits the upside potential of a telecommunications venture and leads to more risk-averse decision making than profit-seeking firms that are willing to take some risks for a chance at high rewards.

5. **Public Decision Process** - In a competitive environment, the City's public decision process is a weakness. It tends to be slow and is conducted openly, potentially forcing the City to publicly reveal proprietary information and plans, placing the City at a competitive disadvantage relative to private competitors. This issue will also confront the Electric Utility in the near future. The City should be able to take advantage of the Electric Utility's experience in bracing for the change to a competitive environment. A partner could also potentially mitigate this problem if the City could delegate some decision making responsibility to the partner.

4. IDENTIFICATION OF STAKEHOLDER INTERESTS

A number of stakeholders will be affected by the telecommunications strategy pursued by the City. The stakeholders include members of the Palo Alto community who would benefit from receiving telecommunications services as well as the telecommunications service providers who

would benefit from having barriers to entry reduced so that it is easier for them to competitively provide telecommunications services in Palo Alto.

4.1. Members of the Palo Alto Community

As was indicated in Phase 3, the overall demand for telecommunications services in Palo Alto is currently estimated to be about $58 million per year (nearly the size of the market served by the Electric Utility). By 2002, this demand is projected to grow to about $83 million per year (about the size of the markets served by both the Electric and Gas Utilities combined). Table 1 itemizes this demand by telecommunications service and market segment.

Local and long distance telephone services represent the bulk of the current market, accounting for 70% of all expenditures, with the remaining 30% split evenly between cable television, Internet access, and the combination of leased conduit, leased bandwidth, and leased network access. While all markets are projected to grow, the most significant growth from 1995 to 2002 is projected to be for Internet access and high speed switched data services, where increasingly high bandwidth connections will be an essential element of service quality. On a market segment basis, the residential market constitutes roughly one-third of the market with the remainder being split evenly between large businesses and institutions (>100 employees) and small businesses and institutions (<100 employees). The City, by comparison, currently spends about $300,000 per year for telecommunications services.

Telecommunications Service		Telecommunications Market Demand, $Millions					
		1995			2002		
		Residences	Small Businesses	Large Businesses	Residences	Small Businesses	Large Businesses
Telephone	Local	$5.9	$4.6	$6.9	$6.0	$4.8	$7.2
	Long Distance	$6.1	$6.1	$12.5	$6.2	$6.4	$13.1
Cable Television		$5.7	$0.04	$0.01	$8.1	$0.06	$0.01
Internet Access		$2.4	$2.3	$1.2	$5.6	$5.5	$2.5
High Speed Switched Data		$0.01	$0.01	$0.01	$3.9	$4.2	$4.9
Leased Infra-structure	Poles & Conduit	$0.0	$2.5	$1.5	$0.0	$2.6	$1.5
	Bandwidth						
	Network Access						
All Services		$20.2	$15.5	$22.1	$29.9	$23.6	$29.3
All Services / All Segments		$57.8			$82.7		

Table 1 - Total Market for Telecommunications Services in Palo Alto

Residential Community - According to 1990 census data, Palo Alto has 54,663 residents living in 24,428 living units. Of these living units, 61% are single family homes, and the remainder in multi-family dwellings, with 7% of the living units in structures with more than 50 units, 7% in structures with 20-49 units, 6% with 5-9 units, and an estimated 19% with 2-9 units. Adjusting

for population growth and problems with census data, it is estimated that Palo Alto currently has about 56,500 residents occupying 25,500 living units.

In a 1994 survey of residential energy use conducted by the Utilities Department, 67% of the respondents indicated that they have a home computer used primarily for personal use, with over a fourth of those respondents with home computers having at least one additional home computer in use. Given the sustained growth of computer sales since this survey was conducted, it is estimated that over 80% of Palo Alto households currently have home computers, about twice the national average.

In that same survey, 17% of the respondents indicated that they operate a home office, with about a third using their home office for 6 or more hours per day, a third for 3-5 hours per day, and a third for 2 or fewer hours per day. Of these home offices, 48% had one office computer (other than a home computer) and 27% had two or more office computers. Over 70% of these home offices had fax machines.

Palo Alto is also home to many members of PA-COMNET, a voluntary group consisting largely of residents and members of the local business community with a vision for enhancing Palo Alto's sense of community by using telecommunications technology to bring people together for the exchange of ideas. On May 8, staff met with PA-COMNET to identify their interests and receive feedback regarding Phases 1-3 of the City's Telecommunications Strategy Study. In preparation for this meeting, staff conducted a survey of the PA-COMNET membership via electronic mail. The survey and a summary of the responses is included in Appendix A.

In general, PA-COMNET expressed support for the City's efforts to date, noting that the City has done a good job reaching out to the community and including PA-COMNET's views in the telecommunications strategy evaluation process. Members pointed out, however, that many of the key stakeholders in Palo Alto do not yet recognize that they are stakeholders and are not aware of the City's study or how it could affect them. Members expressed a concern that the City's risk-averse decision-making could prevent it from making an investment in the community that could pay off as well as the past investments that created the City's current utilities. However, they also recognize the need for the City to act prudently given the competitive environment and rapidly changing technology in the telecommunications industry. The minutes of this meeting, as reported by PA-COMNET to the PA-COMNET electronic mail discussion group, are included at the end of Appendix A.

Business Community - Palo Alto is home to a thriving businesses community that includes over 3000 businesses that employ an estimated 72,000 people. Palo Alto's businesses include leaders in the computer, communications, semiconductor, and aerospace industries, all of which have a strong need for access to the most advanced telecommunications services available. Palo Alto is the site of the corporate headquarters or major R&D facilities for the following major corporations:

- Alza Corporation
- Andersen Consulting
- Beckman Instruments
- Daimler-Benz Research
- Digital Equipment Corporation
- Electric Power Research Institute
- Genencor Corporation
- Hewlett Packard
- IBM
- Internet Shopping Network
- Lockheed Martin Missiles & Space
- Loral Corporation
- Mitsubishi International
- Reasoning Systems, Inc.
- Roche Bioscience
- Seiko-Epson (S-MOS)
- Sutter Hill Ventures
- Systemix
- Varian Associates
- The Wall Street Journal
- Watkins-Johnson Company
- Wilson, Sonsini, Goodrich, & Rosati
- Xerox Palo Alto Research Center
- Yamanouchi Pharmaceuticals / Shaklee

Palo Alto is also home to numerous other businesses that would benefit tremendously from access to advanced telecommunications services (e.g., software developers, Internet service providers, financial institutions, and engineering firms). Among Palo Alto's businesses are 76 organizations with more than 100 employees and about 260 organizations with 20-99 employees.

Staff met with telecommunications managers from four of Palo Alto's largest corporations to identify their telecommunications interests and receive feedback from them regarding the City's involvement in telecommunications. All of the telecommunications managers confirmed that the City had a role to play in telecommunications; however, their views varied regarding the extent to which the City should be involved.

Each corporation has a Palo Alto campus consisting of multiple buildings, most of which are interconnected with private fiber optic or copper cables for internal telecommunications. All four corporations use Pacific Bell for local telephone service. Three use AT&T as a primary long distance carrier; the other uses MCI. Two of the four noted that they use at least one other long distance carrier as a backup. Two of the four corporations have very active telecommuting programs involving Pacific Bell's ISDN[2] service.

All four have been approached by Metropolitan Fiber Systems (MFS), but only one is connected to MFS's fiber network, using MFS as an emergency backup. These companies have also had discussions with other competitive access providers that do not yet have a presence in Palo Alto, such as the Teleport Communications Group (TCG) and Brooks Fiber Communications. Competitive access providers offer to provide these corporations with fiber optic connections that would allow them to transport (or receive) their aggregated voice and data traffic at a discount to (from) selected locations where companies such as long distance carriers or Internet service providers collect their traffic and send it to the appropriate destinations.

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[2]Integrated Services Digital Network (ISDN) is an enhanced service offered by Pacific Bell and other telephone companies over existing phone lines that provides a customer with two digital channels, each with a data throughput capability of 56 kbps, that can be used for either voice or data communications. If the two channels are used in tandem for data communications, a maximum throughput of 112 kbps can be achieved. (By comparison, state of the art modems on traditional phone lines are only capable of a maximum throughput of 28.8 kbps.)

Three of the four corporations stressed service quality and reliability as absolutely critical considerations in the selection of a telecommunications service provider. All recognized price as being very important as well. To attract the telecommunications business of these four corporations, a company will have to offer prices that are lower than Pacific Bell's with assurances of reliability and service quality that are at least as high as that of Pacific Bell. These large users demand personalized, round-the-clock access to a single point of contact that is responsible for meeting their telecommunications service needs.

Even if the City were to provide some of the necessary infrastructure, the telecommunications service providers would be the single point of contact for all service and billing questions so that they could be held accountable. To meet the needs of service providers, the City would need to be on call and ready to respond to their needs on a continuous basis. While the types of fiber optic networks of interest are virtually maintenance-free, the City must be ready to respond in the event that a problem does occur. The City must also be able to quickly reconfigure the network to enable service providers to respond to the changing demands of their customers.

All four corporations expressed some level of reservation about City involvement in providing telecommunications service due to the City's lack of experience. If teamed with an experienced telecommunications service provider, however, they would be more comfortable. Assuming that the right service providers used City infrastructure, some of the telecommunications traffic of these and other corporations would likely be carried over City infrastructure in the near term, with the amount increasing over time if the prices are competitive and the service quality is high.

Medical Community - Included in the business community identified above is a substantial medical sub-community that employs over 10,000 people, with over 5000 people employed at the Stanford University Hospital, and over 1000 people employed at both the Lucille Packard Children's Hospital and the U.S. Veterans Medical Center. Numerous other doctors' and dentists' offices are also located in Palo Alto. With access to advanced telecommunications, detailed medical information could be shared among locations to enable more effective and efficient diagnosis and treatment.

As telecommunications capabilities improve on a national and global scale, telemedicine is emerging as a means of preventing the expertise of specialists from being constrained by geographic limitations. With enhanced telecommunications, Palo Alto physicians could help diagnose and treat patients in other parts of the world, Stanford medical students could learn new techniques from top practitioners, and Palo Alto citizens could gain improved access to medical experts around the world.

Palo Alto Unified School District (PAUSD) - Staff met with PAUSD and found PAUSD to have great interest in the City's Telecommunications Strategy Study. PAUSD's 16 schools are all internally wired, but not connected to each other via a network. PAUSD has an interest in developing a fiber optic network that would interconnect all 16 schools with their District Office and a downtown corporation that would provide PAUSD with access to the Internet. PAUSD expressed an immediate interest in installing fiber to three of the locations and a longer term

interest in the joint development of infrastructure. As such, they are also considered below as a potential partner (see Section 5.2).

Stanford University - Contiguous to Palo Alto, world-renowned Stanford University is an important stakeholder that could benefit from the telecommunications strategy implemented by the City. Stanford employs over 2,700 faculty and has a student population of 13,500. Stanford would benefit if enhanced access to Stanford's computer networks were available for the many faculty and students that live in Palo Alto and for the many Palo Alto corporations that are involved in continuing education programs and joint research projects with Stanford. Stanford would also benefit from improved access to telecommunications carriers with facilities in Palo Alto.

4.2. Telecommunications Service Providers

In order to assess the interests of telecommunications service providers that would potentially use City infrastructure to provide telecommunications services in Palo Alto, staff issued a Request for Information (see Appendix B) to the following companies (most of which were certified by the California Public Utilities Commission as Competitive Local Exchange Carriers):

- AT&T
- Advantage Communications
- Brooks Fiber Communications
- Continental Telecommunications of California
- GST Lightwave (CA)
- GTE Telephone Operations
- ICG Access Services, Inc.
- LDDS Worldcom
- Linkatel Pacific, L.P.
- MCI Metro
- SpectraNet International
- Sprint Telecommunications Venture
- Teleport Communications Group (TCG)
- Viacom Communications
- World Exchange

Staff also sent copies of the Request for Information (RFI) to Pacific Bell and Cable Co-op. Since both companies are already providing services over their own telecommunications they are viewed as potential infrastructure development and operation partners as well as potential service providers.

The purpose of the RFI was to introduce the opportunity for companies to gain direct access to Palo Alto customers without 1.) major investments in infrastructure, or 2.) the competitive limitations associated with using the infrastructure of their competitors. In the RFI, staff requested information regarding the service providers' preferences for various City infrastructure lease and network development options as well as for different types of business relationships that could be pursued.

The City received responses from 6 of the 15 companies that were sent RFIs. In their responses, AT&T, Brooks Fiber, GTE, ICG, SpectraNet, and TCG expressed interest in various types of City telecommunications activities. All respondents acknowledged that the City's existing infrastructure is of significant value and that it could be used to assist them in offering telecommunications services in Palo Alto. If these companies were to serve the Palo Alto market

without City involvement, they would do so by developing their own infrastructure or by reselling service on Pacific Bell's infrastructure.

Four of the respondents would ideally prefer exclusive access to the City's existing infrastructure for the purpose of developing their own telecommunications network, thereby limiting their competition to existing service providers and new entrants that develop redundant infrastructure. All four respondents are also interested in leasing dark fiber, provided it reaches the right locations and is available at the right price. One of the four would also consider leasing capacity on a network on which the City utilized a limited amount of electronics to route traffic between customers and multiple service providers.

The other two respondents expressed an interest in the City developing a fully functional network throughout Palo Alto upon which they could lease access with a minimum amount of investment. None of the respondents expressed a strong near-term interest in building telecommunications infrastructure in residential areas.

Not surprisingly, none of the respondents were willing to commit to a major investment in a network without assurances of exclusivity or much more detail regarding the network design and specific terms of agreement. Three of the respondents did, however, express a conditioned interest in an investment in a network.

In summary, the RFI responses provided useful information to staff and demonstrated an interest by service providers in the low cost market entry opportunity afforded by the City's existing conduit and poles.

4.3. Utilities and Other City Departments

City Departments, particularly the Utilities Department, are also major stakeholders. While existing City telecommunications facilities adequately meet the City's current needs, over time, reliability and bandwidth constraints will require the City to upgrade its telecommunications facilities to an internal fiber optic network. When the City develops additional telecommunications facilities, the Utilities Department as well as other Departments will obtain the potential for a number of benefits. Some would lead to cost reductions; others would lead to improved quality of service. Some of the benefits are associated with access to a fiber ring; others require extensions to customer premises. These benefits are described below.

Potential City Benefits of a City-Owned Fiber Backbone

If the City develops (or has low cost access to) a fiber backbone that is co-located with existing City communications facilities, the City could accrue benefits in the following areas:

Pilot Wire Protection Replacement - The Electric Utility currently uses twisted pair cables to interconnect substations for pilot wire protection. Pilot wire protection is used to identify and correct abnormal situations on the electric distribution system that could damage substations.

Because twisted pair cables are conductors, they are susceptible to interference from high voltage electric distribution lines. Electrical faults can also cause ground potentials to rise and damage the pilot wire protection system. An upgrade to fiber would eliminate these problems. The City's existing pilot wire protection system was installed in 1969 and is approaching an age at which replacement is recommended. Anaheim's twisted pair pilot wire protection system, by comparison, was 35 years old when it was replaced by 50 miles of fiber optic cable.

Coaxial Cable System Replacement - The coaxial cable (coax) system currently provides telephone and data interconnections between City facilities and is used for the Electric Utility's supervisory control and data acquisition (SCADA) system and for traffic signal monitoring and control. The original coax system was constructed in 1986. It has since been upgraded with a new tie leg and a major amplifier replacement. Based upon existing demands, this system could easily be operated for another 10 years or more and is currently operated at about 50% of its capacity

Nevertheless, there may be reasons to supplement the coax system and/or eventually migrate telecommunications traffic off it entirely. A fiber ring would be more reliable and have lower operation and maintenance costs than the coax system. A fiber ring would also provide much more bandwidth than the coax system. Although bandwidth limitations are not currently a problem, they could be in the next 5-10 years. If new fiber were co-located with the major segments of the coax system, the City would be well positioned for an easy migration when appropriate. Once in place, abundant bandwidth would enable the City to take advantage of emerging applications that require high bandwidth and offer enhanced service quality and/or overall cost savings.

A fiber network would also allow for easier interconnection of facilities. The coax system has specific interconnection points (taps) that dictate where connections can be made. Part of the reason that the coax system is not extended to more City facilities is that these connection points are not always located in the right places. To add additional connection points to a given leg of the coax system, that leg must be taken out of service while the cable is cut and a tap is added to the cable. With fiber, backup fibers would be available which would allow traffic to be diverted to a backup fiber while a connection is made on the primary fiber.

Video Traffic Detection - Video traffic detection is an emerging application that requires high bandwidth telecommunications connections, but promises cost reductions and service quality improvements over existing traffic detection systems. At intersections with traffic signals, the City currently uses a wire loop in the street to detect the presence of the vehicle above it. This information is transmitted over the coax system to the Municipal Service Center where the traffic is monitored and the timing of traffic signals is controlled. A problem with this approach is that roads must be cut open after they are paved so that traffic detection loops can be installed. These must be reinstalled every time a road is paved, leading to a direct cost of about $1000 per loop and substantial indirect costs due to road degradation. Video traffic detection mitigates such road degradation problems.

Video traffic detection uses cameras mounted on top of traffic signals to supply real-time video footage of traffic conditions to a computer that processes the images to determine traffic intensity and respond appropriately. The City is currently experimenting with a video traffic detection monitor at the corner of Middlefield Road and Embarcadero Road. In addition to avoiding street cuts, video traffic detection offers enhanced capabilities.

Such monitoring would enable the City to identify not merely if a single vehicle is present, but how many vehicles are present. Such monitoring was implemented successfully near Anaheim Stadium to reduce traffic clearing times after stadium events from one hour to 35 minutes. Similar systems have also been deployed for policing applications, such as in Campbell, CA where they have been used to identify and ticket cars that do not stop at red lights. While the City's coaxial cable system could handle video traffic detection at a limited number of traffic signals, it does not have enough capacity to implement such a solution on a City-wide basis.

Library Interconnection - The City's six libraries are all interconnected using leased data lines from Pacific Bell and modems that allow for inter-library data transmission at a rate of 9600 bits per second. Three of the libraries (the Main, Mitchell Park, and Children's Libraries) have also been connected to the City's coax system which will allow for much faster data transmission rates.

The Main Library has a central computer that runs the library automation system and provides transparent access to library resources on the Internet. The central computer can be accessed from computer terminals and personal computers at all of the City's libraries or remotely via dial-up connections using modems. This access allows library patrons to check the holdings and availability of materials via the City's on-line catalog and will soon allow patrons to search the indexes of over 1000 magazines and retrieve full text from over 650 of them. The City is also in the process of developing access to the library catalog via the City's Web page on the Internet.

The trend is toward making more graphical information available electronically. For example, an increasing number of library materials are now available in an interactive, graphical CD-ROM format. These software products provide reference materials with voice, video, music, graphics, and text that are much more useful than printed text alone. It would be useful to enable such products to be networked so that they could be accessed at any library, or potentially from users' homes. Another example is the Palo Alto Historical Association's vast collection of fragile photographs that could be stored in a graphical file database. These digital files could then be accessed any number of times without damaging the aging photographs.

To consistently access such graphical information with reasonable response times, much higher speed connections are necessary. If the City develops a fiber backbone, available routings would enable the backbone to be installed in close proximity to all six libraries. This would provide an opportunity to upgrade library communications capacity when it is appropriate to do so.

"Virtual libraries" have started to emerge that can be accessed electronically, tremendously enhancing the resources available at any given library. It is anticipated that the amount of

information available in such libraries will expand dramatically. Virtual library patrons will be able to remotely access a vast array of documents available at information repositories worldwide. In addition to maintaining a physical collection of books and other library materials, the City could become both a repository and an access point for information stored in a digital form. With access to a fiber optic network interconnecting the City's libraries, the City will have the potential to offer greatly expanded information access at a lower cost per user than would be needed today to provide comparable access.

Long Distance Bypass - The City currently spends over $50,000 per year on long distance telephone service. Of the money paid to the City's long distance service provider, roughly 40% is paid by the long distance carrier to the local exchange carriers (e.g., Pacific Bell) on either end of the call. If the City were to use the fiber backbone to transport long distance calls directly to and from its long distance carrier, thereby bypassing Pacific Bell, the City could expect to reduce its long distance costs by up to 20%. This would lead to an annual cost reduction that could be as high as $10,000.

Additional PBX Extensions - The City currently uses a Private Branch Exchange (PBX) system with facilities located in City Hall and the MSC to reduce the number of direct lines between the City and Pacific Bell, and thereby keep local telephone costs down. A telephone that is connected to the PBX can be used to dial any other telephone connected to the PBX using only the last four digits of that telephone's phone number. To place an outside call using the PBX system, a "9" must be dialed first.

The coax system is currently used only to connect the PBX facilities in City Hall and at the MSC. The City connects 225 other off-premises extensions to the City PBX by leasing "OPX" lines from Pacific Bell at an annual cost of about $175,000. To the extent that City fiber optic facilities reach additional City facilities, it could be used to connect additional extensions directly to the City's PBX; however, the costs of the necessary additional equipment would have to be weighed against the avoided lease costs. Demand for enhanced data communications at these locations would further support interconnection with a City-owned fiber backbone.

High Bandwidth Interfacility Communications - In the next few years, the Utilities Department will need to provide one or more computers at the MSC with high speed access to the City's Geographic Information System (GIS) located in City Hall. This and other potential applications requiring high bandwidth (i.e., throughput) connections for interfacility communications (e.g., real-time graphical file transfer for system maintenance, access to graphical maintenance records, remote video-based training, and desktop video conferencing) could strain the capacity of the existing coaxial cable system.

Potential City Benefits of Extensions to Customer Premises

If the City develops (or has low-cost access to) telecommunications facilities that include not only a fiber backbone, but also extensions off the backbone to customer premises, the City could potentially accrue benefits in the following areas:

Automated Meter Reading - Currently, Utilities Department staff manually read electric, gas, and water meters once per month. As long as the meters are only read once a month, there will be little potential for system-wide automated meter reading (AMR) to provide cost savings for Utilities. However, if the Electric Utility chooses to implement pricing schemes requiring hourly meter reading, AMR would be essential. If Utilities implements AMR, it would benefit if it had low cost access to two-way telecommunications links to customer premises.

The low potential for cost savings associated with using AMR for monthly meter reading is attributable to Utilities spreading the cost of a meter reading visit over three meters, resulting in very low costs per meter read. A 1994 consultant study estimated an average cost of about $9 per meter per year.

Compared to this, the cost of establishing an AMR program is quite high. Vendors estimate the cost of retrofitting the City's existing meters for AMR at $100-$130 per meter. Utilities would have to invest in computer equipment that would receive, organize, and store the meter data. Furthermore, water meters tend to be located separately from electric and gas meters, requiring a separate telecommunications link to the central computer system or to the electric and gas meter location where data would be combined before being sent to the central computer system. Automated monthly meter reading is estimated to have a payback period of 20 years, which is greater than the life of the AMR system components.

Nevertheless, there is still a role for AMR. An AMR pilot program will soon be implemented at a limited number of sites to test AMR in selected applications. One such application is the use of AMR to reduce meter reading costs for meters that are difficult and costly to access, such as those located in remote areas, behind locked gates, and in dangerous locations (e.g., a water meter at the bottom of a deep vault, a meter under a house, meters guarded by unfriendly dogs). Another AMR application that will be evaluated is the use of AMR at sites that are potential candidates for real time pricing. In addition to the AMR pilot program, AMR techniques are also being used to perform load research with about 100 businesses in Palo Alto.

Additional AMR would be needed if the Electric Utility chooses to follow the meter reading requirements that the California Public Utilities Commission has imposed on investor-owned utilities (IOUs) such as PG&E as part of the electric utility industry restructuring process. Starting in January 1998, IOUs will be required to make hourly meter reading available for an initial group of customers (representing all customer classes: residential, commercial, and industrial) for the purpose of real-time pricing. Participating customers will be responsible for the cost of the necessary meters, which includes attendant facilities such as communications and the power supply.

With real-time pricing, customers are sent hourly price signals by their electricity provider so that they may modify their electricity usage patterns if desired. The goal of real-time pricing is to use a market-based mechanism to shift electric loads from expensive peak periods to inexpensive off-peak periods. IOUs will be required to make real-time pricing available to all of their customers by 2003; however, it is unlikely that many residential customers will be able to

reap enough savings from real-time pricing to justify the cost of installing new meters. Should the Electric Utility choose to offer real-time pricing to some or all electric customers, it will need to implement AMR for those customers.

If Utilities chooses to implement AMR for any reason, City-owned telecommunications facilities would facilitate end-to-end control of the system and may provide the potential for some cost savings. However, the cost of telecommunications for AMR is small relative to the other cost components. As a result, the potential to realize AMR cost savings through the use of additional City telecommunications facilities is limited.

Other Potential Utilities Benefits - With two-way telecommunications links between the Utilities Department and customers, a variety of additional services would be possible. Utilities would be able to instantly detect and pinpoint the location(s) of power outages, remotely disconnect customers' electric service, and prevent theft via enhanced meter tamper detection. The Electric Utility could monitor power quality to detect problems and correct them before they cause problems with customers' computers and other power quality-sensitive equipment. The Electric Utility could monitor electricity consumption by selected equipment to help identify areas of potential customer cost savings. With remotely-controlled demand-side management, customers could also control selected appliances (e.g., heater or air conditioner) remotely to save money without sacrificing comfort. Such enhanced capabilities would enable Utilities to provide higher quality service to its customers.

5. QUALITATIVE EVALUATION OF ALTERNATIVE STRATEGIES

In the first three phases of this study, the City's telecommunications strategy decision was reduced to a choice between the following two strategies:

1. ***Lease Existing Infrastructure*** - The City actively leases spare conduit and pole space to private telecommunications network developers and/or companies in Palo Alto interested in establishing point-to-point telecommunications links.

2. ***Develop a Network and Lease Access*** - The City develops a new telecommunications network, independently or with one or more partners, and leases access to all interested services providers.

Although existing infrastructure can be leased in only a limited number of ways, there are many ways that a network could be developed for the purpose of leasing access to service providers. These include variations in the type of network developed, the partner(s) involved, and the financing mechanism(s) used. Taking these variations into consideration, the range of potential City telecommunications strategies is summarized in Table 2 and explained in the following sections. For the purpose of defining alternatives and for describing phased implementation schemes, the network is divided into three distinct pieces: the backbone, extensions to large businesses and other high demand telecommunications customers, and extensions to small businesses and residences.

General Strategy	Potential Network Technologies				Potential Partners				Potential Sources of Financing
	Type of Network Deployed by City (and Partner, if any)	Type of Cables Installed by City							
		Backbone	High Demand Customer Extensions	Residential & Small Business Extensions	Cable Coop	Pac Bell	CAP	TND	
Lease Existing Infrastructure	None	None	None	None					Electric Utility
Develop a Network and Lease Access	Dark Fiber Backbone	Fiber Optic	None	None			X	X	Third Party Financing Revenue Bonds General Obligation Bonds Electric Utility
	CAP Network ("Fiber to the Building")		Fiber Optic	None			X	X	
	Hybrid Fiber-Coax		None	Coaxial Cable	X	X		X	
	Fiber to the Curb			Twisted Pair		X		X	
	Switched Digital Video			Coax & Twisted Pair	X	X		X	
	Fiber to the Home			Fiber Optic		X		X	

Note: CAP = Competitive Access Provider (e.g., MFS)
TND = Telecommunications Network Developer (e.g., SpectraNet)

Table 2 - Complete Range of Potential City Telecommunications Strategy Implementations

5.1. Potential Infrastructure Lease and Network Development Options

A major difference between the two strategies is the level of control the City has over the development of telecommunications facilities in Palo Alto. While the City has more control if it develops a network than if it leases existing infrastructure, there are different levels of control possible with each. This leads to a range of levels of control rather than two discrete levels of control for these two strategies.

If the City leases existing infrastructure to the highest bidder, it will have little control over the development of telecommunications facilities. If other elements (e.g., municipal connectivity, residential build out schedules, etc.) are included in the process for selecting the company to which the City would lease existing infrastructure, the City could gain additional control.

If the City chooses to take a more active role in developing a telecommunications network, it will have more control over the network. However, given that the City will not provide services directly and will likely require a partner to help design, construct, and/or operate the network, the City will not have complete control over its development and implementation.

Greater control for the City represents an opportunity for the City to more directly influence the availability of services and to generate greater net earnings; however, with this greater control comes greater responsibility, a higher price tag, and greater exposure to risk. The City must carefully consider its competitive advantages and scrutinize the risks and rewards of obtaining a controlling position when determining how much control to seek.

5.1.1. Potential Network Architectures

Naturally, if the City leases only existing infrastructure, there is no need for a network. But, if the City develops a network, at least six separate types of networks are possible. These network types are briefly described below. Note that, although a partner is not mentioned, it is believed that a partner would be needed for any network other than a dark fiber backbone.

Dark Fiber Backbone - The City co-locates a fiber ring around the City with existing Utilities communications cables. Some fibers are reserved for internal City uses, with the vast majority available for lease to interested parties. This is passive infrastructure consisting solely "dark fiber", implying that there are no electronics provided by the City.

Competitive Access Provider Network ("Fiber to the Building") - In addition to a dark fiber backbone as described above, the City extends fiber to the buildings of major telecommunications users, provisions the network with electronics, and leases dedicated capacity on the shared network to interested parties.

The remaining network types represent four different approaches to delivering services to residential and small business customers. They are assumed to be developed in addition to a dark fiber backbone.

Hybrid Fiber-Coax (HFC) - Fiber is extended to neighborhood nodes where optical signals are converted to electrical signals and carried over coaxial cables to serve 200-2000 homes and/or businesses per node. The coaxial cables are arranged in a "bus" configuration, meaning that the same information is sent to every home and small business connected to a given node. A special coding technique (encryption algorithm) is required to ensure that certain types of information, such as phone calls or data transmissions, are kept private.

HFC is the architecture of choice for the delivery of cable television service because it offers tremendous bandwidth at a low cost for signals that are broadcast to all customers. It is also being deployed by some companies, such as Pacific Bell, for delivery of multiple services including telephone and data services. HFC networks capable of providing telephone service are more expensive than those used exclusively for video and data transmission due to the need to provide backup power to enable the provision of lifeline telephony service during power outages.

Fiber to the Curb (FTC) - Fiber is extended to curbside nodes where optical signals are converted to electrical signals and carried over twisted pairs that are extended to 4-24 homes and/or businesses per node. The twisted pairs are arranged in a "star" configuration, meaning that unique information streams are sent to every home.

The FTC architecture is similar to that of existing telephone networks, with fiber replacing the twisted pair cables between a central office and the curbside nodes. FTC is ideal for providing telephone service, but has significant bandwidth limitations relative to HFC.

Switched Digital Video (SDV) - SDV is a combination of the HFC and FTC architectures. As in FTC, fiber is extended to curbside nodes where optical signals are converted to electrical signals and twisted pairs are extended in a star configuration to 4-24 homes and/or businesses per node. Additionally, coaxial cable is overlaid on the FTC network to provide one-way delivery of standard, broadcast analog video and to provide power for the curbside nodes. SDV provides the benefits of both HFC and FTC, but at a slightly higher cost.

Fiber to the Home (FTH) - In a passive FTH network, fiber is extended to curbside nodes where the optical signal is split into several identical optical signals and then extended directly to 8 or 16 homes and/or small businesses per node. Privacy protection measures as in HFC are needed for information sent *to* customers. Such measures are not needed, however, for information sent *from* customers because it does not pass through other customers' premises. FTH provides the most bandwidth and is the least expensive to operate and maintain, but has the highest initial cost. Active FTH networks, in which unique optical signals are sent to every customer, are also possible, yet are even more expensive to construct.

5.1.2. Service Capabilities / Limitations of Alternative Network Architectures

In the final analysis, Palo Alto residents and businesses are not concerned with the type of network deployed, but rather, with what telecommunications services are available, how much they cost, and how reliable they are. Given the telecommunications strategies under consideration, the City will not independently determine these factors, but will have the opportunity to influence them through terms in an infrastructure lease agreement or through the type of telecommunications infrastructure it decides to develop.

Common Service Capabilities for all Residential / Small Business Networks Considered

While the type of network that is deployed determines the type of services that can be offered, most services demanded today could be offered over any of the networks introduced in Section 5.1.1. Each network has its advantages and disadvantages, but if configured properly, each is capable of delivering a range of services offered by multiple service providers. A distinction is made between voice, video, and data services because they have different information delivery

requirements[3]. The networks under consideration are all technically capable of supporting the following services.

- Voice Services
  - Plain Old Telephone Service ("POTS")
  - Long distance access for businesses (bypassing Pacific Bell)
  - Remote PBX interconnection for businesses

- Video Services
  - Switched digital television (including video-on-demand)
  - Video conferencing
  - Video games

- Data Services
  - Internet access
  - Telecommuting (remote LAN access, file sharing, etc.)
  - Remote LAN interconnection for businesses

The real test for comparing networks, however, is not ***if*** these services could be deployed, but rather, ***how expensive*** it would be to deploy these services at a given level of service quality.

High Bandwidth Services

All network architectures have bandwidth limitations, with more severe limitations for some than others. Because of these limitations, some high bandwidth services could not be offered with some network designs by even a single service provider. Table 3 summarizes the number of service providers that could be supported by each of the network designs for some example high bandwidth services.

5.2. Potential Partners

Cable Co-op - Cable Co-op has expressed an interest in partnering with the City. Cable Co-op has extensive coaxial cable infrastructure that extends throughout Palo Alto and neighboring communities. Roughly half of Cable Co-op's infrastructure and customers are located in Palo Alto. Cable Co-op currently provides cable television service and is conducting high speed data trials with selected customers.

[3]Future advances in a type of network technology (asynchronous transfer mode, or ATM) will likely enable transmission of all types of information across the network in a consistent manner; however, cost-competitive, commercially available technology requires that voice traffic be treated differently than data and video traffic.

High Bandwidth Service Description	Type of Network			
	Hybrid Fiber-Coax	Fiber to the Curb	Switched Digital Video	Fiber to the Home
Standard, broadcast analog cable television (including near-video-on-demand)	1	0	1	1
Broadcast digital television (including near-video-on-demand)	>1	0	>1	>1
Future services (e.g., broadcast HDTV, virtual reality)	?	0	?	>1

Table 3 - Maximum Number of Service Providers for High Bandwidth Services

Cable Co-op is burdened by an estimated $37 million debt load that equates to roughly $1400 of debt per customer ($700 per home passed), with a $6.8 million payment due in May 1998 and a $23 million balloon payment due in February 1999. Cable Co-op will need to refinance this debt or attract a financial partner in order to stay in business. Additionally, Cable Co-op's infrastructure must be upgraded to improve reliability and provide adequate capacity for the provision of high speed data service to more than just a limited number of customers. Given that the cost of developing a new hybrid fiber-coax network (with capabilities comparable to those of Cable Co-op's contemplated upgrade) is estimated at $500-$700 per home passed, Cable Co-op will face significant financial challenges in the near future.

Regardless of Cable Co-op's financial challenges, their extensive coaxial cable infrastructure represents a potential platform for delivering high speed data service that is highly demanded by many Palo Alto residents and businesses. Whether it is Cable Co-op or a successor that uses Cable Co-op's infrastructure to pursue this market, they will need to upgrade it with fiber to increase the network's capacity to a level suitable for widespread deployment of data services.

The City could help ensure that Cable Co-op's infrastructure is capable of providing widespread data services in Palo Alto by installing fiber optic cable in the locations necessary to upgrade the Palo Alto portion of Cable Co-op's infrastructure to a hybrid fiber-coax network. In such an arrangement, Cable Co-op would technically be viewed as a service provider leasing access to City telecommunications facilities rather than a partner. In this way, the City can maintain neutrality among service providers.

To keep risk low, the City would need to reach terms with Cable Co-op that would provide sufficient guarantees that lease payments would continue to be made by Cable Co-op or Cable Co-op's successor. In the event that Cable Co-op is forced to sell their cable system, the purchaser would benefit from having the network upgraded with fiber and would likely wish to continue leasing the fiber rather than building their own or reverting back to an all coaxial cable system. Continuation of fiber lease payments could be included as necessary terms of the sale.

Telecommunications Network Developer / Operator - The City has been approached by several telecommunications network developers who have an interest in partnering with the City. The interests of such developers cover both pure infrastructure leases and various partnering arrangements.

Pacific Bell - Pacific Bell is an unlikely partner because the City's key assets (poles and conduit) are of little value to Pacific Bell. Pacific Bell jointly owns poles with the City and has its own conduit in which it could install fiber optic cable. Given this infrastructure, Pacific Bell has little incentive to partner with the City. Staff have nevertheless contacted Pacific Bell and are awaiting a response. It is possible that Pacific Bell may want to use fiber installed by the City rather than installing it themselves.

Metropolitan Fiber Systems - Metropolitan Fiber Systems (MFS) is an unlikely partner because the City's key assets, poles and conduit, are of little value to MFS. MFS already owns fiber and spare conduit in the primary business districts of Palo Alto that MFS prizes most. For this reason, MFS was not contacted as a part of this study.

Palo Alto Unified School District (PAUSD) - As stated above in Section 4.1, PAUSD has an interest in developing a fiber optic network to interconnect all 16 schools with their District Office and a downtown corporation that would provide access to the Internet. Many of these sites are located in close proximity to existing Utilities' communications lines. To the extent that the City and PAUSD are interested in running fiber down the same routes, there would be an opportunity for mutual benefit through sharing labor costs and fiber cable sheath costs (assuming the City and PAUSD owned fibers in a common cable). PAUSD's schools also represent potential sites for locating network equipment.

Stanford University - Stanford is a potential partner. Stanford has expertise and rights-of-way that could be of value to the City. Combined with the City's existing infrastructure and the number of Palo Alto businesses and residents affiliated with Stanford that have an interest in high speed telecommunications links to Stanford, there appears to be an opportunity for significant mutual benefit to both communities.

Neighboring Cities - The City does not have poles or conduit in neighboring cities and would have to lease space on poles and in conduit or develop new underground facilities (such as MFS did in Palo Alto). In either case, the City would not enjoy the same competitive advantage for providing services in those cities that it does in Palo Alto. There would be some economies of scale associated with a larger market; however, these benefits alone are not likely to be sufficient to justify the added cost of serving these markets without a partner that could provide access to existing facilities (such as Cable Co-op or Pacific Bell) or assume responsibility for the additional capital outlay required.

5.3. Potential Financing Mechanisms

Given the City's objective of limiting its financial risk, City financing would only be pursued for strategies with limited risk. Higher risk ventures would need to be financed privately. The

available financing options are briefly summarized below. Depending on the investment, they could be pursued independently or in combination. Without knowing the specific terms of the financing options, however, the City can not meaningfully evaluate them.

City Financing - For a limited investment, a startup loan could be made using electric utility reserves. For such a loan, the risk would need to be minimal. The Electric Utility is bracing for the competitive transformation that has been initiated the electric utility industry. An investment in telecommunications infrastructure would provide the benefit of diversifying the Electric Utility's investment portfolio and providing infrastructure that could be used to improve utility operations (as described in Section 4.3), but it would also tie up funds that could be needed to help the Electric Utility respond to competitive threats. A minimal, low risk investment may be acceptable; large investments or high risk investments are not.

As described in the Phase 3 Supplemental Report, the City could consider the following two municipal bond options for financing a project requiring higher levels of investment:

- **Revenue Bonds** (Payments are secured by revenues generated by the project.)
- **General Obligation Bonds** (Payments are secured by the City's general fund incomes.)

Partner Financing - A network development partner could also provide some or all of the financing, thereby shifting risk from the City to the partner. This concept has been suggested by SpectraNet and ICG Access, but specific details have not yet been proposed. Until such details are known, the City can not effectively evaluate this financing concept.

Service Provider Financing - In the Request for Information, service providers were asked if they would have an interest helping to finance a network in exchange for different forms of return on investment. While none of the respondents were willing to commit to a major investment in a network without assurances of exclusivity or much more detail regarding the network design and terms of an agreement, three respondents did express a conditioned interest in a network investment. As in the case of partner financing, without specific financing proposals, the City can not evaluate this financing option.

6. QUANTITATIVE EVALUATION OF ALTERNATIVES

During the first three phases of this study, the City Council indicated that their overall goal with telecommunications is not to maximize returns to the City's general fund. Rather, the Council is interested in maximizing the benefit delivered to the community subject to the constraint that financial risk to the City must be limited or non-existent. As such, the main purpose of the quantitative analysis was to assess the level of risk associated with alternative City telecommunications strategies. A second purpose was to assess the expected returns for the strategies given the uncertainties that affect their financial performance.

This section summarizes the analysis of the strategies that best meet the City's objectives of accelerating the delivery of advanced telecommunications services to all customer classes with

limited or no financial risk imposed upon the City. Complete documentation of the analysis of these and other potential, but less promising, strategies is presented in Appendix C.

6.1 Overview of the Strategy Decision

The critical decision that the City Council will face in August is whether or not to develop a fiber backbone in a ring around the City. To construct such a backbone, the City would co-locate fiber with existing Utilities' telecommunications lines (coaxial and twisted pair cables), in conduit in underground districts and on poles in overhead districts. It is assumed that the fiber backbone would be designed with the flexibility to accommodate a number of different implementations, thereby enabling the City to defer the decision regarding the best use of the fiber to a later date.

6.2 Definition of Strategies Quantitatively Evaluated

A number of specific strategies were defined and quantitatively evaluated in Phase 4. Those strategies that were determined to best address the needs of all customer classes without imposing an undue amount of financial risk upon the City are shown in Table 4. Note that if the City decides to pursue a "Develop Network and Lease Access" strategy, there are four possible variations identified, all of which involve the construction of a $1.5 million fiber backbone as the necessary first step.

General Strategy	New Infrastructure Developed in Palo Alto by the City (and Partner, if any)			Specific Strategy Evaluated	Estimated Distribution Network Construction Cost ($Millions)
	Install Fiber Backbone?	Additional Infrastructure for Large Businesses and Other High Demand Customers	Additional Infrastructure for Residents and Small Businesses		
Lease Existing Infrastructure	***No***	None	None	Strategy A	$0.0
Develop a Network and Lease Access	***Yes***	None	Fiber Extensions for Co-op HFC Nodes	Strategy B1	$2.7
			None	Strategy B1c	$1.5
		SONET Hubs and Additional Fiber	Fiber Extensions for Co-op HFC Nodes	Strategy B2	$4.9
			None	Strategy B2c	$3.6

Notes
1 - Strategies B1c and B2c represent contingency strategies that would be pursued in the event that the City is unable to reach agreeable lease terms with Cable Co-op under Strategy B1 or B2.
2 - The construction costs for Strategies B2 and B2c include the cost of fiber laterals extended to the premises of an assumed 100 customers.

Table 4 - Summary of Strategies Quantitatively Evaluated in Phase 4

Each of these strategies is described below. Note that with each strategy, although not explicitly quantified, it is assumed that the City could lease additional conduit or pole space to others upon request on an as-available basis.

Strategy A - Lease Existing Infrastructure
The City leases an estimated 150 miles of conduit and pole space to a single telecommunications network developer (TND) that agrees to make services available to all businesses and residents in geographically accessible locations in Palo Alto by a specified date. The City requires 8 fibers to be reserved in the TND's primary fiber ring, at no charge, for the City's internal use. Since some of the conduit and pole space will be shared with existing Utilities communications lines, the TND must agree to joint access terms established by the City. The TND also must provide assurances that guarantee residential service availability. (The City could also choose to lease existing infrastructure without residential service requirements, but the quantitative model for Strategy A involves the lease of extensive infrastructure throughout Palo Alto.)

Strategy B - Install a Fiber Backbone as a Necessary First Step in Developing a Network
The City co-locates fiber cables in conduit and on poles with existing Utilities' communications lines to create a 15-mile ring of fiber around the City that passes through residential areas and reaches all major business districts. The City reserves 8 fibers for internal use and uses the remaining fibers as the foundation of one of the following specific strategy implementations:

- **Strategy B1 - Dark Fiber Backbone with Dark Fiber Extensions for Cable Co-op (or Cable Co-op's Successor)**
  As soon as the backbone ring is constructed, the City immediately begins leasing a portion of the available fibers to interested parties, who will likely be companies that are interested in developing fiber networks to serve the largest users of telecommunications in Palo Alto. The City also pursues fiber lease negotiations with Cable Co-op for a deal under which the City would use fibers in the fiber ring plus additional fiber extensions to connect Cable Co-op's headend with the future locations of Hybrid Fiber-Coax (HFC) node sites to be installed by Cable Co-op (or its successor)[4].

- **Contingency Strategy B1c - Dark Fiber Backbone**
  Should the City be unable to reach agreeable lease terms with Cable Co-op (or its successor), the City would make the remainder of the fibers on the backbone available for lease.

---

[4]Cable Co-op's headend is located near 3200 Park Boulevard. It is the central point of a coaxial cable or hybrid fiber-coax network from (to) which all signals flow. The HFC nodes are the points at which the optical signals carried on fiber are converted to (from) electrical signals which are carried from (to) the nodes to (from) customer premises on coaxial cables. Based on feedback from Cable Co-op, it is estimated that 56 HFC nodes would be sited in Palo Alto.

- **Strategy B2 - Competitive Access Provider Network with Dark Fiber Extensions for Cable Co-op (or Cable Co-op's Successor)**
  After the fiber backbone ring is constructed, the City extends fiber off the ring down additional streets in major business districts and provisions some of the fibers with SONET[5] hubs to form a competitive access provider (CAP) network. As customers request services from telecommunications service providers that are connected to the network, the City extends fiber laterals to the customers' premises. The City also pursues negotiations with Cable Co-op for a deal under which the City would use fibers reserved on the backbone ring plus additional fiber extensions to connect Cable Co-op's headend with the future locations of HFC node sites to be installed by Cable Co-op (or its successor).

- **Contingency Strategy B2c - Competitive Access Provider Network**
  Should the City be unable to reach agreeable lease terms with Cable Co-op (or its successor), the City would use the remainder of the fibers on the backbone to connect customers to the CAP network.

6.3 Results of the Quantitative Evaluation

Detailed financial models were prepared for each strategy using relatively conservative, nominal case assumptions for all variables. Note that the "nominal case" models do not account for the significant uncertainty that will influence the outcome of each strategy. For this reason, by themselves, they do not represent an acceptable basis upon which to make a decision. They are, however, an essential part of the analytical framework that does account for uncertainty.

To account for differences across strategies in the remaining value of the new infrastructure developed, a residual value was assessed by assuming that the business was sold at the end of year 10 for a price equal to four times the operating cash flow in year 10. The net present value (NPV) of net cash flow over a ten year period was adjusted to account for this residual value and used as the bottom line measure of performance for the strategies evaluated. The resulting ten year NPV of net cash flow is shown in Table 5, along with the NPV of all revenues and costs, for each strategy.

[5]Synchronous Optical Network (SONET) is a standard that has been developed for the electronics that manage the flow of digital information over optical telecommunications networks.

Net Present Value of Projected Cash Flows (Nominal Case), $Millions (NPV calculated over a 10 year period using a 6% discount rate)					
	Strategy A	Strategy B			
	Lease Existing	Develop a Network and Lease Access			
Revenue / Cost Component	Infrastructure	Strategy B1	Contingency Strategy B1c	Strategy B2	Contingency Strategy B2c
Revenues					
Pole Leases	$0.12	$0.00	$0.00	$0.00	$0.00
Conduit Leases	$5.84	$0.00	$0.00	$0.00	$0.00
Dark Fiber Leases	$0.00	$18.79	$7.15	$11.64	$0.00
Bandwidth Leases	$0.00	$0.00	$0.00	$13.04	$13.04
Total Revenues	$5.96	$18.79	$7.15	$24.68	$13.04
Costs					
Distrib. Network Construction	$0.00	$2.74	$1.51	$4.02	$2.79
Other Network Costs	$0.00	$0.40	$0.23	$2.15	$2.29
New Customer Hookups	$0.00	$0.00	$0.00	$0.79	$0.79
Personnel Costs	$1.01	$2.48	$1.83	$5.44	$5.13
Finance Costs	$0.03	$0.18	$0.12	$0.26	$0.21
Other Costs	$0.03	$0.03	$0.03	$0.03	$0.03
Total Costs	$1.07	$5.82	$3.73	$12.69	$11.24
Net Cash Flow	**$4.89**	**$12.97**	**$3.41**	**$11.99**	**$1.80**
Residual Value of New Assets	$0.00	$7.50	$2.68	$9.46	$4.41
Adjusted Net Cash Flow	**$4.89**	**$20.47**	**$6.10**	**$21.45**	**$6.21**

Table 5 - Net Present Values of Projected Cash Flows (Nominal Case), $Millions

A probabilistic analysis was implemented using a combination of decision analysis and simulation (e.g., Monte Carlo simulation) techniques. Decision analysis techniques were used to frame the problem as shown in the decision tree in Figure 4. Simulation was then used to probabilistically analyze the problem using this framework.

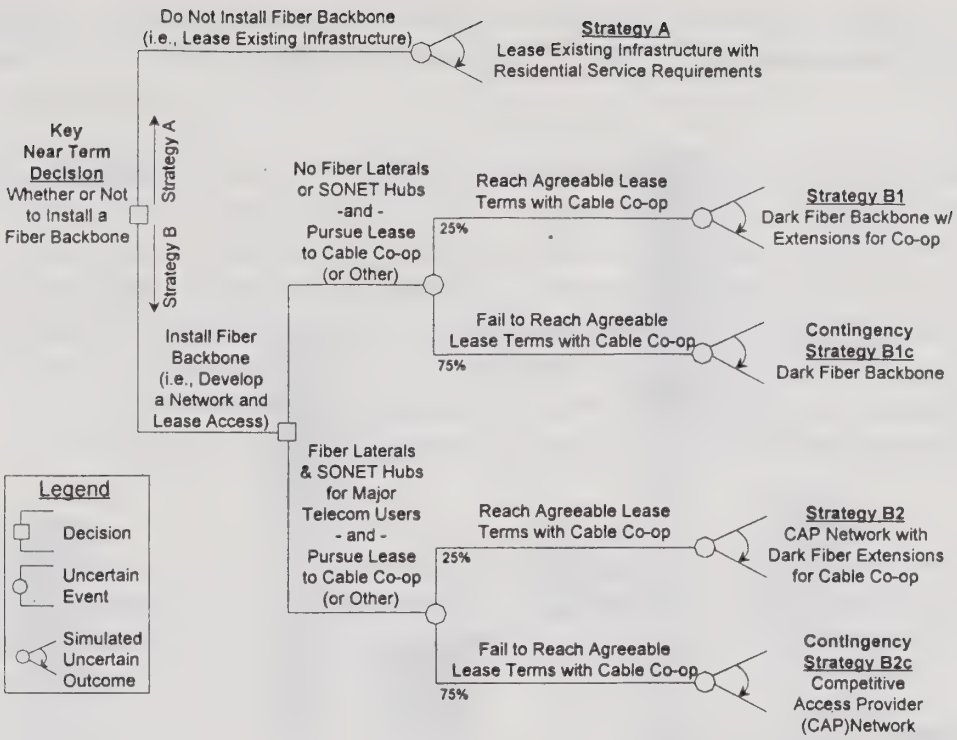

Figure 4 - Telecommunications Strategy Decision Tree

The resulting simulated outcomes for the endpoints in Figure 4 are summarized in Figure 5 as three primary strategies and two contingency strategies. The range from the bottom to the top of a given bar spans the full range of possible outcomes for that strategy. The top dark-shaded portion of the bar for a given strategy represents the highest 10% of possible outcomes; the bottom dark-shaded portion represents the lowest 10%. This implies that there is a 10% chance that the actual NPV will be greater than the NPV at the 90% point and a 10% chance that the actual NPV will be less than the 10% point. The light-shaded portion in the middle, therefore, represents a range over which the actual NPV has an 80% chance of occurring. The dark horizontal line is the probabilistic expected value of the distribution of outcomes. It is the average value of all of the outcomes in the simulation.

Strategy A, the Lease Existing Infrastructure strategy, represents the lowest risk, but also the lowest upside potential. Strategy B1 is also very low risk because the City is able to limit its investment by providing only fiber optic cable with very limited staffing. Strategy B2 offers tremendous upside potential in the Competitive Access Provider market, but involves more risk due to the need to invest more in infrastructure and staffing and the need to prove to large customers that the City network can reliably carry their critical telecommunications traffic. A partner could potentially reduce the risk associated with this strategy.

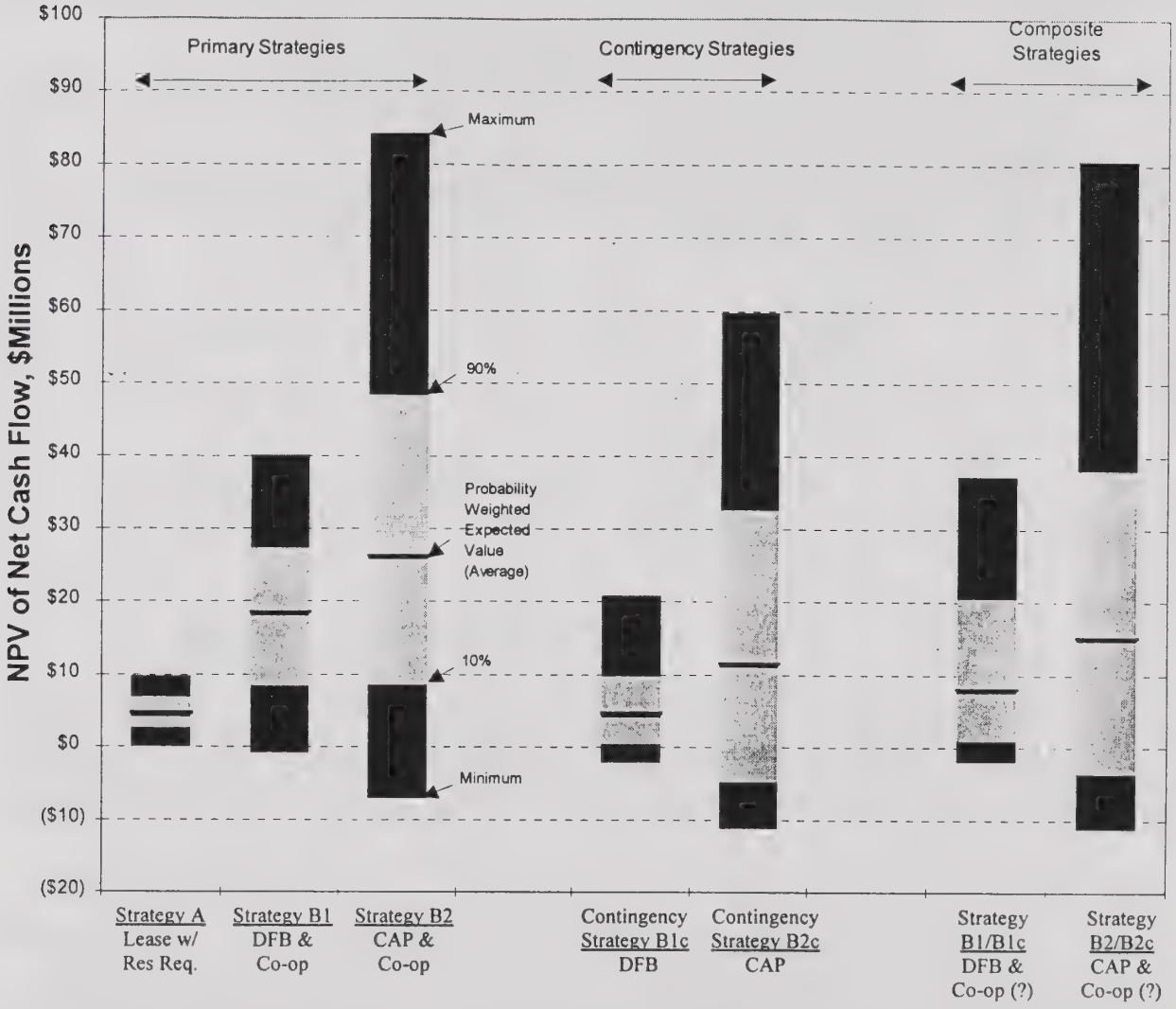

Figure 5 - Statistical Summary of Simulated Outcomes for Each Strategy

In the primary strategies shown in Figure 5, Strategies B1 and B2 assume that the City will reach acceptable lease terms with Cable Co-op (or their successor) and lease fiber for at least one year and most likely ten or more years. However, it will not likely be known in advance of the August Council meeting if the City will be able to reach acceptable lease terms with Cable Co-op. The contingency strategies are strategies that could be pursued in the event that the City installs a fiber backbone with the intent of leasing some of the available fibers to Cable Co-op but fails to come to agreement on lease terms.

Contingency Strategy B1c demonstrates a limit on the risk associated with installing fiber before reaching agreeable terms with Cable Co-op. It assumes that the additional fibers installed in the backbone ring for use by Cable Co-op are never used and sit idle, generating no revenues (an unlikely scenario -- but clearly a worst case) and that the City incurred costs of $50,000 during the failed negotiation process. As is shown, the anticipated revenues from leasing the Dark Fiber Backbone would offset this cost and make it highly unlikely that the City would suffer an overall

loss. (Although unlikely, Contingency Strategy B2c similarly assumes the worst case in which the additional fibers installed in the backbone for use by Cable Co-op are never used and sit idle generating no revenues.)

The two composite strategies at the far right of Figure 5 are based on the City pursuing Strategy B1 or B2 combined with a belief that there is a 75% chance that the City will not be able to reach agreeable lease terms with Cable Co-op. In the event that an agreement is not reached, these composite strategies assume that the City pursues Contingency Strategy B1c or B2c and never uses the fiber installed for Cable Co-op. These strategies identify the probability-weighted results of installing the fiber backbone under these uncertain conditions. As is shown, the risk exposure is minimal if the City pursues a Dark Fiber Backbone-based approach, and small relative to the upside potential if the City pursues a Competitive Access Provider-based approach.

The detailed cumulative probability distributions for Strategy A and the two composite strategies for Strategy B are presented as risk-reward profiles in Figure 6. These risk-reward profiles can be used to identify staff's assessment of the probability that the outcome of a given strategy will be greater than or less than a given value.

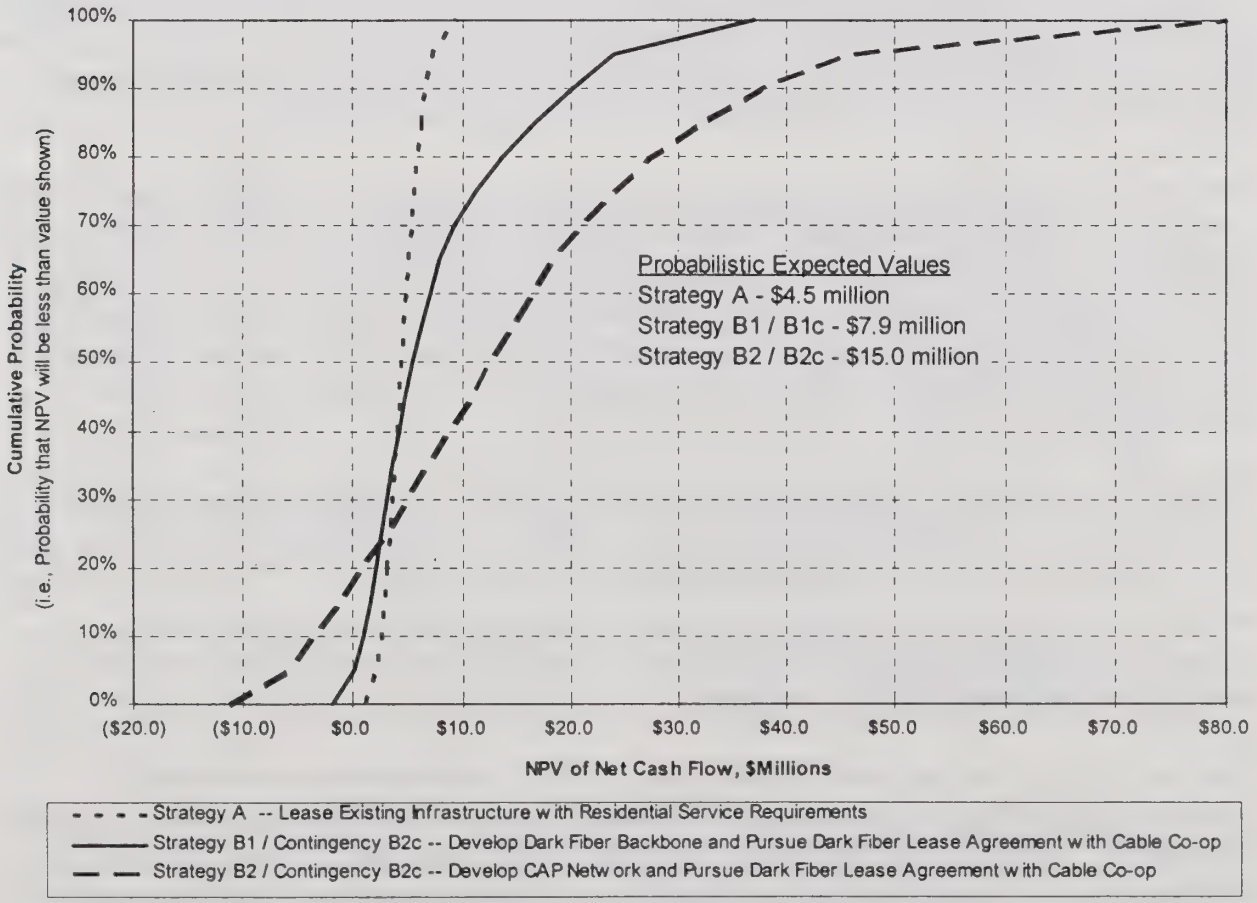

Figure 6 - Detailed Risk-Reward Profile Comparison

7. ADDITIONAL CONSIDERATIONS

The preceding sections provide a substantial basis upon which to draw conclusions. This section introduces some additional issues that should be kept in mind.

7.1. Limitations of Quantitative Analysis

The purpose of the quantitative analysis was to assess the level of risk associated with a limited number of specific strategies. To accomplish this, the evaluation examined a range of possible outcomes for those strategies, including worst case scenarios for contingency strategies. In an effort to keep the model relatively simple, and because the primary purpose of the analysis was to analyze worst-case scenario risk exposure, realistic intermediate contingency strategies were ignored.

As a result, the network development strategies do not account for the full amount of flexibility that the City would have in determining how best to use the fiber backbone installed under Strategy B. This leads to the probability distributions that understate the realistic potential of the specific implementations of Strategy B. For example, if the City developed a fiber backbone with the intent of leasing a portion of the fibers to Cable Co-op (or its successor), but was unable to reach acceptable terms for the lease of those fibers, it was assumed that they would sit idle and generate no revenues. Realistically, the City would offer them for lease to other parties and would almost certainly generate revenues from at least a portion of those fibers.

Another important factor is that strategies involving the City building a hybrid fiber-coax (HFC) network without using any of Cable Co-op's infrastructure were also analyzed, as documented in Appendix C, but not presented in Section 6 because of the unacceptable level of risk associated with these strategies. Part of the risk of a full network deployment is associated with the rapidly changing nature of residential network technologies. By waiting a few years, the City may find that standards have been developed and that costs have come down sufficiently to justify developing such a network.

Only HFC networks were quantitatively analyzed because they are capable of providing most services that will be demanded for the foreseeable future and because they have the lowest initial cost of the four residential network technologies described in Section 5.1.1. This does not imply that the City should exclude the others from consideration in the future should the City reexamine network development. In a few years, it may make economic sense to extend fiber directly to homes as well as large businesses.

Since the City does not have any concrete proposals from telecommunications network developers or agreements with service providers to evaluate, it is difficult to know exactly what the outcome will be for a given strategy. This should not prevent the City from making a decision, however, because the City has a number of attractive strategies from which to choose, as was demonstrated in the quantitative analysis.

7.2. Assessment of Intangible Factors

Finally, there are some intangible factors that should also be considered.

Ease of Implementation - While leasing existing infrastructure appears to be straightforward, if the City wishes to require a telecommunications network developer to make services available to all businesses and residents by a specified date, a significant effort will need to be made to include appropriate assurances in a binding agreement. It is anticipated that a telecommunications network developer would be selected through a competitive Request for Proposals (RFP) process. Such a requirement would increase the complexity of the RFP and may significantly limit the field of interested and eligible telecommunications network developers.

It would also add to the amount of time required to select a winning candidate with which to negotiate an agreement. The City of Anaheim, for example, issued an RFP for such a telecommunications network developer in April 1995, selected a winner in January of 1996, and will not likely know whether or not an acceptable agreement can be negotiated until at least September 1996. If Palo Alto's City Council directed staff to implement a similar RFP process, assuming Utilities Advisory Commission review, staff would not be able to return with a proposed RFP until October 1996 at the earliest. Assuming a schedule similar to Anaheim's, the City may not know if will reach acceptable terms with a telecommunications network developer until March 1998. By that time, others will likely have entered the market to serve large business customers with additional fiber infrastructure.

If the City Council instead opts for Strategy B and directs staff to issue an RFP for the development of a fiber backbone, the fiber backbone could be much more quickly constructed. If an RFP for a fiber backbone design and installation is issued in October 1996, it is estimated that construction could be completed by May 1997. By initiating the fiber backbone design and installation process, the City will be considered more seriously by telecommunications service providers and potential customers. While construction is being completed, the City could engage in negotiations with telecommunications service providers and perform additional market research with potential customers to help reduce uncertainty and assist the City in deciding how best to use the fiber backbone once it is installed. It is realistic to assume that at least a portion of the fibers installed could generate revenues almost immediately.

Organizational Requirements - Strategy A involves a significant amount of up-front involvement to complete the RFP and negotiation processes. Once an agreement is in place, however, Strategy A would require a fraction of a full time equivalent (FTE) of ongoing staff involvement.

Strategy B would initially require the creation of a new position to manage the backbone RFP and construction processes and to continue investigating the best use of the backbone. Once constructed, a fiber technician would be required to maintain the fiber network. A technician could either be hired or this work could be outsourced. After the backbone is constructed,

additional staff may be required if the City decides to do something more than lease dark fiber on the backbone ring.

Control of Infrastructure - A significant advantage of Strategy B over Strategy A is control of infrastructure. If the City installs its own fiber backbone, it will be able to determine how it should be used and will have the opportunity to stimulate competition. If a single telecommunications network developer develops the fiber backbone, it will be in its best interest to maintain complete control of the fiber and try to keep potential competitors out of Palo Alto. This would limit customer choices, contrary to one of the City's objectives. Furthermore, Strategy B would allow Utilities to continue to be the only party with access to the conduit and pole space where existing Utilities communications lines reside. This would keep the risk of damaging existing Utilities communications lines low and avoid jeopardizing the City's core electric business.

8. CONCLUSIONS AND RECOMMENDATIONS

On the basis of the information presented above, if the City wishes to position itself to help deliver the maximum community benefits and meet the objectives approved by the City Council, it should pursue Strategy B by installing a fiber backbone ring and continuing to examine how to best use them to benefit the community while the backbone is being installed. This approach would position the City to pursue Strategy B1, Strategy B2, or something else entirely should an opportunity present itself. This strategy would offer the City tremendous upside earnings potential with very limited financial risk.

However, if the City's sole objective is to minimize financial risk to the exclusion of other stated objectives, it could pursue Strategy A and lease existing infrastructure. In addition to financial considerations, Strategy A has the drawback of placing the City's telecommunications destiny in the hands of a single telecommunications network developer with the hope that it will successfully deliver a wide range of low cost, high quality services throughout Palo Alto. Strategy B offers the City more control and better positions the City to create a competitive telecommunications marketplace consisting of multiple telecommunications service providers. Furthermore, Strategy B allows the City to maintain exclusive access to the conduit in which existing Utilities communications lines reside. This removes the risk of the telecommunications network developer damaging existing Utilities communications lines.

Based upon these factors, staff recommends that the City pursue Strategy B as a positioning strategy by installing a fiber backbone in a ring around the City. At this time, it is not necessary to specify *exactly* how the fibers will be used. While the fiber ring is being constructed, it is recommended that staff continue to investigate how best to use the fibers in the ring.

This recommendation constitutes a low cost, incremental step that is fundamental to any network development alternative. By co-locating the fiber with existing Utilities' communication lines, this also provides for a natural migration of Utilities' communications to fiber in the future as

bandwidth demands increase and our existing communications systems' reliability decreases with age.

The cost of constructing the fiber ring is estimated at $1.51 million. Additional costs of $350,000 are estimated during FY 96-97 for legal counsel, construction oversight and inspection, maintenance equipment, and the addition of one Full Time Equivalent staff position to manage telecommunications activities. After the first year, ongoing costs are estimated to be $210,000 per year. It is recommended that the initial costs be financed with Electric Utility reserves. These costs are expected to be recovered over a 3-5 year period, with mature net cash flows in excess of $1 million per year projected thereafter. (See Appendix D for financial model details.)

Such a strategy would position the City with a number of attractive infrastructure development or lease options. There is no immediate need to make a final decision regarding exactly which strategy implementation (i.e., B1, B1c, B2, or B2c) the City should pursue. The City should take advantage of the time between now and when the fiber ring is constructed to continue to gather additional information from service providers and potential customers. This should reduce the amount of uncertainty the City will face when determining the next steps following construction of the fiber ring. Regardless of what the City decides to do after installing the fiber ring, it will be a valuable asset that will last into the future, offering at a minimum the potential for substantial lease revenues.

City of Palo Alto

TELECOMMUNICATIONS STRATEGY STUDY

PHASE 4 REPORT
Volume 2 - Appendices

June 19, 1996

Prepared by Staff

City of Palo Alto
Telecommunications Strategy Study
PHASE 4 REPORT - VOLUME 2
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Volume 2 - Appendices

APPENDIX A

Summary of Input from PA-COMNET

A.1. Telecommunications Survey Responses

List of Survey Questions

1. Please estimate your monthly expenditures for telecommunications services for your home and/or small business. Please itemize your by service type (local phone lines, long distance, Internet access, cable television, etc.) and service provider (e.g., Bell, AT&T, Cable Co-op, etc.).

2. How are you currently employed?

3. On average, how many hours per week do you work out of your home?

4. How many hours per week do you access the Internet or other data networks?

5. At what speed (kilobits per second) do you currently access the Internet.

6. What City services should be delivered over telecommunications facilities?

7. If available, would you review your Palo Alto Utilities bill electronically?

8. If available, would you pay your Utilities bill electronically?

9. How important is competition in the Palo Alto telecommunications marketplace?

10. What questions am I not asking that I should be?

Survey Response Rate

PA-COMNET Distribution - 90 email addresses
Eligible[1] PA-COMNET Population (Rough Estimate) - 50% of email addresses
Number of Survey Responses - 9
Response Rate - 20%

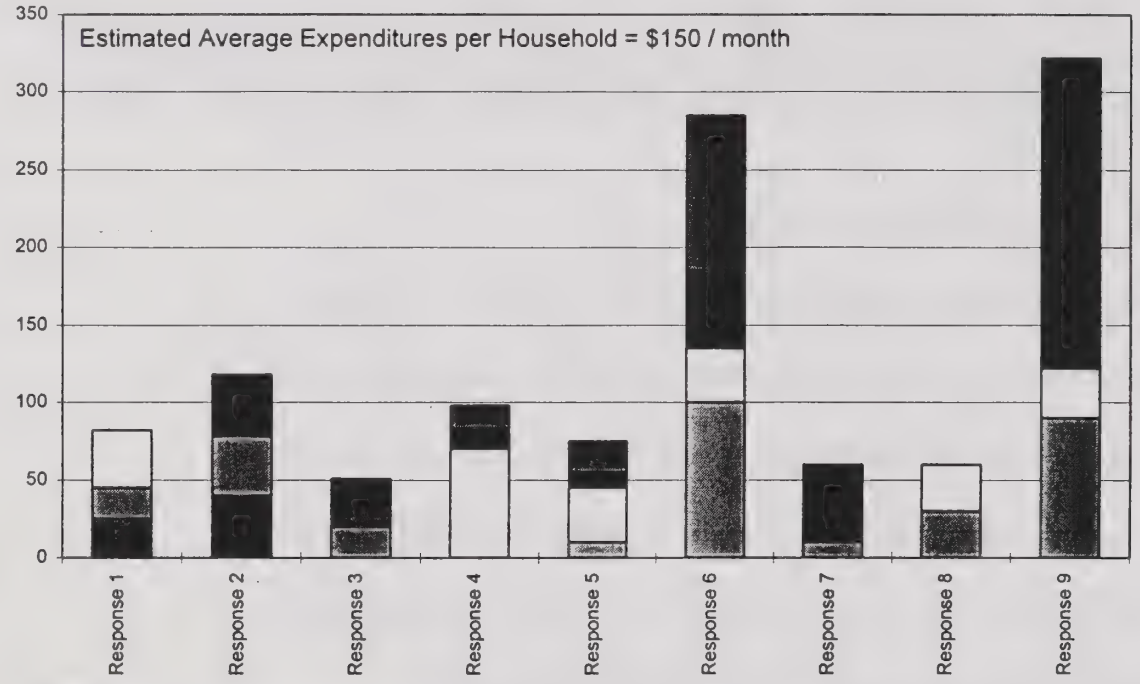
Q1 - Q5

Responses to the first five questions are summarized on the following page.

[1]This accounts for duplicate email addresses and the belief that some people did not respond because they do not live or work in Palo Alto or are City employees (although not explicitly stated as a restriction in the survey).

SUMMARY OF PA-COMNET SURVEY RESULTS
(Questions 1-5)

PA-COMNET Member Telecommunications Expenditures (Q1)



Notes

Responses 5, 8, and 9 each cover 2 people.

Responses 1 and 8 did not indicate amount of telephone expenses; Response 3 did not indicate amount of cable TV expenses.

Response 8 also incuded $1370 for T1 Internet access at small business location in Palo Alto.

Estimate of average household expenditures compensates for data gaps and does not include office expenses.

Responses to Question 2
Range of Professions Represented in Responses
3 Independent Consultants
2 Computer Scientists
2 Engineers
2 Web Page Developers
1 Chemist
1 Education Policy Researcher
1 Self-Employed

Note

Three responses represented 2 people in the households.

Responses to Questions 3, 4, and 5				
	Work at Home	Internet (or Other Data) Access		
		Time Online	Data Rate (kbps)	
Respondent	(Hrs./ Wk.)	(Hrs./ Wk.)	Home	Office
Response 1	10	13	28.8	
Response 2	20	20	112.0	
Response 3	0	8	28.8	
Response 4	10	40	28.8	1540
Response 5	40	5	28.8	1540
Response 6	60	30	64.0	
Response 7	Varies	5	2.4	
Response 8	25	90		1540
Response 9	40	8	28.8	
Average	26	24	40	1540

Q6 - Suggested Uses of Telecommunications Facilities to Enhance City Services

- Broadcast public meetings (real-time)
- Use the Web site and/or electronic mail to:
  - Post meeting agendas, staff reports, letters from the community, meeting minutes, etc.
  - Post archived information that has been converted from paper to digital form.
  - Allow remote participation at public meetings.
  - Streamline permitting and licensing processes.
  - Provide electronic versions of common forms.
  - Enable electronic payment of Utility bills and other City fees.
  - Allow submittal of ARB applications.
  - Provide space for local businesses to provide their own information.
  - Allow schools to post homework assignments.
  - Email directory of City staff that is searchable by name, department, function, etc.
  - Archive PA-COMNET mailing list discussions.
- Sponsor a community conferencing system

Q7 - If available, would you review your Palo Alto Utilities bill electronically?

Yes - 5 responses
No - 2 responses
Maybe - 2 responses

Q8 - If available, would you pay your Utilities bill electronically?

Yes - 5 responses
No - 3 responses
Maybe - 1 responses

Q9 - How important is competition in the Palo Alto telecommunications marketplace?

Not Very Important - 2 responses
Very Important - 2 responses
May Be Important - 1 response
Question Unclear / No Opinion - 4 responses

Q10 - What questions am I not asking that I should be?

- Should the City become an Internet service provider?
- What speed Internet access would you like to have (upstream and downstream)?
- What are the benefits of involving the entire community?
- How can advanced telecommunications improve education, reduce commuting, make the area more competitive, and empower people by allowing two-way high capacity interaction?
- Can Utilities improve efficiency by using a two-way system for meter reading, load management, assuring stable system performance, etc.?
- How can the joint powers cities get involved?
- What is the cost of cable modems vs. other types of converters?
- Should access to homes be via TV or computers? Why?
- How much are people willing to pay for various services?

A.2. Minutes from the May 8, 1996 PA-COMNET Meeting

The meeting began at 7:40 with Bernie Strojny, Assistant City Manager, and Van Hiemke of Palo Alto Utilities describing the status of the City's telecommunications objectives and strategies. The objectives were discussed extensively with the community and the Council over the past several months. They include a broad provision of services to the entire community, not just businesses. They also believe that costs will be lower with City involvement, and the City's experience with a utility system will provide an advantage.

Results of the Phases 1-3 study were summarized. The objectives are:

- Accelerated deployment of a broad range of advanced telecommunications services to all citizens and businesses in Palo Alto.
- Decreased costs for both conventional and advanced telecommunications services (as compared to the costs for similar services if provided without City involvement).
- High quality for both conventional and advanced telecommunications services.
- Enhanced competition among telecommunications service providers and increased telecommunications choices for consumers (who are presently limited to monopoly local phone and cable service providers).
- Limited or no financial risk exposure to the City.

The City Council eliminated doing nothing and competing directly as telecommunications strategies after Phases 1-3 were completed.

What PA-COMNET members think about the goals and objectives, and what may have been missed or should be modified is of great interest.

Bill Cutler wanted to know how the process is working, who are the stakeholders, and have all of them been involved?

Bernie noted that the City attempted to involve the community by working with the Telecommunications Advisory Panel and PA-COMNET to provide feedback, plus the business community, Utilities Advisory Committee, Council members, and members of the public. All of them have been involved and participated in the study and review. There were public meetings and hearings on the topic, interviews were held with community members and a range of opinions were sought. No issue in Palo Alto goes to the Council without extensive discussion and this was actively discussed.

Jay Thorwaldson noted that there was a good effort by the City to reach out and involve people,

but many stakeholders don't yet know they are stakeholders.

David Harris asked about how content on the system may or may not be controlled. Will City involvement cause problems?

Margaret Cooley wanted to know what the city means by no financial risk. Isn't it reasonable to take some risk and also be able to profit later?

Bernie said that the City understands there would be some up-front costs. It's unclear how it would work, especially with a partner. There could be buffering of expenses with a partner, but it doesn't mean that the City would shy away from some initial cost. There could be significant expenses for 3-7 years, after which the enterprise works quite well and is profitable. Van noted there will be tradeoffs where no single alternative meets all objectives. They will have to be evaluated by the council.

Louis Bookbinder (Booky) was surprised that the city seems reluctant to invest in telecommunications utilities considering their past involvement with other utilities. It's known that telecommunications is different from standard utilities, but why is there such concern about the difference?

Bernie noted that utilities were a monopoly, but telecommunications aren't, so it has to be looked at more carefully.

Jay noted that originally there were a number of small utilities all producing their own power as monopolies. This situation is different, and much faster moving. The professors who began the City utility operations in 1896 are considered visionaries today.

Bill asked how they will handle rapid technological change, and deal with obsolescence.

Bernie noted that this is a real concern. Technology moves very rapidly and the City doesn't plan to hire it's own experts.

We then discussed the strategies being evaluated which are:

1) leasing existing infrastructure such as spare duct and pole space to private telecommunications networks/developers and or companies interested in establishing point-to-point communications links.

2) Developing a network and leasing access by working with a partner who will develop a new telecommunications network and lease access to all interested service providers. The City would limit its role to providing links between customers and service providers.

Bob noted that partnering allows the city to avoid the risks of trying to outguess technology by letting the partner react to changes in the environment. A local private business will be better able to respond quickly to changes in technology. Cable Co-op has been using their system for 3 years to provide experimental data and communications services with Hybrid Networks, Com21 and others. They have been approached by a number of organizations to serve as a test bed for new technology.

Is any consideration being given to serving the entire joint powers area, not just Palo Alto? The area certainly has lots of people interested in the high speed data service. A visitor at the Cable Co-op Board meeting last night was willing to replace his ISDN line with a cable modem, pay as much as $500 - $1000 for installation, and $80/month for service if he could get the access. There are many others like him who want the service, in Palo Alto, Menlo Park, Stanford and Atherton.

Bob noted there will be significant initial costs because it will take time to build a customer base, costs are high at this time for equipment and installation, and it will take time to recover these costs. After 5 or 6 years the costs for modems and equipment as well as installation will be lower and there will be a much larger market. It will be more effective for the City to have a small private organization such as Cable Co-op understand and implement new technologies than the City. They are inherently quicker to react.

Bernie said that reaction from major businesses and PAUSD was very positive about City involvement in telecommunications. PAUSD is particularly supportive. The recommendations from the Phase 4 study will go to the UAC in June and to the City Council in August. At this time there is no move to expand beyond Palo Alto as that may be more than they can handle.

The partnerships possible include working with Cable Co-op, with other telecommunications organizations such as AT&T, etc. There's lots of interest in working with the City by many organizations. They want to minimize the number of times the streets and infrastructure are torn up by telecommunications companies laying cable. It's very disruptive to have repeated street construction.

Jay asked about forming partnerships with several entities such as Cable Co-op and PAUSD and then going with that partnership to form other partnerships.

Margaret liked the idea of partnerships, and cautioned that the city hasn't the expertise to operate a competitive telecommunications facility. Use of partners will allow use of their experience and expertise and allow faster reactions to events and changing technology.

Dave wanted to look at using existing systems more. There is access to almost everyone now and it could be used. For example, phone companies have ADSL, there is wireless, and the cable companies also can provide access now.

Keith Cooley noted that all existing systems have some limitations, such as low speed upstream access for ADSL, limited capacity for high speed modems in cable systems, and low speed for wireless. It's important to have a system capable of high speed upstream delivery so that individuals also can be publishers.

Bernie said that there is lots of interest in serving the high capacity businesses who will provide revenue. The City could use that income to serve the rest of the community over time. It may require phasing in to serve all residential areas. The system would be a fiber ring with a central processor, but users wouldn't be able to tell how the system worked since it would be so fast.

Van said Palo Alto has had an internal telecommunications system for years, including a coax system between municipal facilities. The City already has a certain expertise in communications and servicing a communications network.

Bill noted that there should be more emphasis on societal values and interconnections. Pure financial issues shouldn't govern.

Kathryn also noted the importance of involving all residents and neighborhoods, and building community. It's a great opportunity to bring people together and improve interactions.

Bernie commented that Austin, TX is working with a utility to develop a network which will provide services to the entire community, including energy management and telecommunications. Other cities such as Anaheim also are getting directly involved in telecommunications. It isn't considered very unusual anymore. Since these utilities are using the fiber system for energy management and other functions of an electrical utility it's easier to justify spending utility money for the upgrade.

Nine of us filled out the e-mail survey. A copy with the results was distributed. The staff wants others to respond also. (If you haven't responded yet please e-mail back your replies).

The meeting adjourned at 8:35 AM.

APPENDIX B

Request for Information
from Telecommunications Service Providers

City of Palo Alto
Telecommunications Strategy Study
Request for Information
from Telecommunications Service Providers

Date Issued: April 8, 1996

Response Due Date: May 1, 1996

Please deliver response by mail or fax to:

Bernard M. Strojny
Assistant City Manager
City of Palo Alto
250 Hamilton Avenue
Palo Alto, CA 94301
(fax) 415-328-3631

Introduction and Background

The City of Palo Alto is interested in promoting competition among telecommunications service providers throughout Palo Alto while ensuring that the negative impacts of telecommunications infrastructure development are kept to a minimum. At this time, the City is not interested in providing telecommunications services directly to end users. Rather, the City is considering as one option the development of a telecommunications access network consisting of telecommunications infrastructure that could be shared by multiple service providers. The City could pursue this independently or with a network management partner that would not provide telecommunications services to end users. The City is requesting information from your company that will play a critical role in evaluating the merits of this option.

Should the City develop a telecommunications access network, the first step would be the development of a route-diverse, fiber optic ring that would reach all major business districts and pass through all residential areas in Palo Alto. This ring could be quickly and inexpensively constructed by co-locating fiber in ducts and on poles with an existing City-owned coaxial cable communications system used for utilities SCADA, City PBX and LAN interconnection, and traffic signal control throughout Palo Alto.

Fiber extensions would then be made to businesses with substantial demands for telecommunications services. The City could directly lease fiber to service providers as "dark fiber" or could equip it with electronics (e.g., multiplexers, cross-connects, switches, etc.) to perform additional network functions.

Ultimately, fiber, coaxial cable, and/or twisted pair extensions could be made to small businesses and residents to develop a standards-based, broadband telecommunications access network that, unlike the existing single service-oriented networks of today (e.g., telephone and cable television), could be easily shared by multiple voice, video, and data service providers.

With this Request for Information, the City of Palo Alto is assessing your interest in providing telecommunications services in Palo Alto over infrastructure owned and managed by the City. It is important that your response consider all the relevant technical and business aspects of working with the City. Given the broad scope of the information requested, you may wish to have more than one person from your company respond to this document. Please provide the following information for the key people involved in preparing your response:

Name
Title
Company
Address
Telephone Number
Fax Number
Email Address
Role in Preparing Response

Section 1 - Service Offerings

1. What is the primary business of your organization at the present time?

2. What telecommunications services would you be interested in offering to Palo Alto businesses? Please identify the relative importance of being able to offer each of the services.

3. What telecommunications services would you be interested in offering to Palo Alto residents? Please identify the relative importance of being able to offer each of the services.

4. In the absence of City involvement, how would you deliver these services (e.g., wireless delivery, leased wireline access, development of new wireline infrastructure)?

Section 2 - Telecommunications Access Network Options

(Engineering staff should be involved in responding to the questions in this section.)

1. If the City chooses to develop a telecommunications access network consisting of fiber optic infrastructure extending to major telecommunications users in Palo Alto, the City will need to determine the level of functionality to include in the network, bearing in mind the needs of telecommunications service providers and their Palo Alto customers. How useful would each of the following network configurations be for your company? Which would you prefer and why?

    a. The City does not equip the network with any electronics. The City only offers dark fiber pathways in the form of permanent point-to-point connections.

    b. The City equips the network with multiplexers to offer fiber pathways that are routed between customers and service providers on a semi-permanent basis using a shared, SONET-based, high speed network backbone.

    c. The City equips the network with multiplexers, cross-connects, and SONET-based transport on both the backbone and the extensions to customer and service provider locations. This allows customers and service providers to directly connect a variety of telecommunications equipment to fiber pathways that are routed between customers and service providers on a semi-permanent basis using a shared, SONET-based, high speed network backbone.

    d. Other (please describe).

2. If a fiber optic backbone is developed and the City wishes to use it to facilitate the provision of telecommunications services to small business and residential customers, would your company be interested in providing services to these customers? If so, how useful would each of the following network extension options be for your company? Which would you prefer and why?

   a. The City leases fiber optic backbone capacity and available duct and pole space to your company to allow your company to develop a telecommunications network.

   b. The City develops a telecommunications access network that routes traffic between customers and multiple voice, video, and data service providers who lease access on the network. Service providers, rather than the City, own and operate equipment such as Class 5 telephone switches.

   c. The City develops a telecommunications access network that performs all major switching operations, including those performed by equipment such as Class 5 telephone switches. Multiple voice, video, and data service providers gain access to customers by leasing ports on network equipment owned and operated by the City.

   d. Other (please describe).

3. If the City develops a telecommunications access network that serves small business and residential customers, do you have preferences or opinions regarding particular network access architectures such as hybrid fiber-coax, fiber-to-the-curb, switched digital video, and fiber-to-the-home?

Section 3 - Business Relationship

1. The City is considering two options for using the City's existing infrastructure to facilitate the provision of telecommunications services to the businesses and residents of Palo Alto. Which of these two options would you prefer and why?

   a. The City offers to lease space on existing infrastructure (i.e., utility poles and ducts) to a telecommunications infrastructure developer interested in developing a telecommunications network in Palo Alto.

   b. The City develops and manages a telecommunications access network and leases access to multiple services providers.

2. The City of Palo Alto may decide not to invest in a telecommunications access network without some advance assurance that service providers would lease access on the network once it is constructed. Assuming acceptable terms could be reached, would you be willing to enter into an agreement for use of City telecommunications infrastructure prior to its construction? If so, what type of terms should be included in order for such an agreement to be deemed acceptable?

3. The City may be interested in attracting financing to help fund the construction of a telecommunications access network that could be used by multiple service providers. We believe that your company would stand to benefit from the existence of such a network and, given the right terms for a return on investment, may be interested in financing a portion of its cost. To what extent would the following forms of return on investment entice your company to help finance a Palo Alto network? Are there other forms of return on investment that should also be considered?

   a. In exchange for an investment in the network construction, an investing service provider receives an agreed upon rate of return that is delivered over time in the form of free network access (i.e., waived lease fees).

   b. In exchange for an investment in the network construction, an investing service provider is able to use the network some number of months in advance of non-investing service providers. Service providers with investments of different magnitudes gain access at different times, using a pre-established formula in which the number of months for each service provider is determined by the magnitude of the investment.

   c. In exchange for an investment of at least some minimum threshold level, an investing service provider is given the opportunity to participate in the network design and construction process, assisting the City with decisions such as the selection of a network architecture, an equipment vendor, a partner (if any), and a buildout schedule.

   d. Other (Please describe.)

4. The City currently issues Utilities bills to every residence and business in Palo Alto that aggregate fees for electric, gas, water, sewer, storm drain, and refuse collection services. If the City develops a telecommunications network, should telecommunications bills be handled separately by service providers? Or should the City aggregate telecommunications billing information furnished by service providers with the services currently included on the City's Utilities bill statements? Why?

5. What else could we do to make this concept work better for you and the businesses and residents of Palo Alto?

Section 4 - Background Information and Experience

1. How many years has your company been in business?

2. What other companies have ownership stakes in your company?

3. How many people does your company currently employ? How many of those people are located in California? How many are located in the San Francisco - Oakland - San Jose metropolitan area?

4. What were the revenues, net income, and assets for your company in 1995? Approximately what percentage of your revenues, net income, and assets were attributable to business you conducted in California in 1995?

5. Please describe your company's experience in the following areas:

    a. Providing the services you are interested in offering (as identified in your responses to the questions in Section 1).

    b. Developing and managing telecommunications networks.

    c. Working with other cities and electric utilities.

6. Please provide relevant references that we may contact.

APPENDIX C

Quantitative Analysis Documentation

C.1. Introduction

The quantitative analysis presented in Volume 1, Section 6 of this report includes results for only those strategies that best meet the City's objectives of accelerating the delivery of advanced telecommunications services to all customer classes with limited or no financial risk imposed upon the City. This appendix provides complete documentation of the quantitative analysis of all strategies evaluated, including a number of strategies not presented in Section 6.

Since the strategies in Section 6 represent a subset of all strategies evaluated, they were renumbered to simplify presentation. Table C1 relates the strategies presented in Section 6 to their equivalent strategies presented here in Appendix C. Note that the number of fiber cables was not raised as an issue in Section 6. This issue is explained below.

Section 6 Strategy Number	Appendix C Strategy Number	Number of Fiber Cables	Strategy Description
Strategy A	Strategy 2	Zero	Lease Existing Infrastructure with Residential Service Requirements
Strategy B1	Strategy 5	Two	Dark Fiber Backbone with Dark Fiber Extensions for Cable Co-op
Strategy B1c	Contingency Strategy 5a	Two	Dark Fiber Backbone
Strategy B2	Strategy 6	Two	Competitive Access Provider Network with Dark Fiber Extensions for Cable Co-op
Strategy B2c	Contingency Strategy 6a	Two	Competitive Access Provider Network

Table C1 - Corresponding Strategy Numbers Between Section 6 and Appendix C

C.2. Overview of the Strategy Decision

The critical decision that the City Council will face in August is whether or not to develop a fiber backbone in a ring around the City. To construct such a backbone, the City would co-locate fiber with existing Utilities' telecommunications lines (coaxial and twisted pair cables), in conduit in undergrounded areas and on poles in overhead areas. It is assumed that the fiber backbone would be designed with the flexibility to accommodate a number of different implementations, thereby enabling the City to defer the decision regarding the best use of the fiber to a later date.

Where underground, existing Utilities' communications cables reside in 3" or larger conduits, leaving ample room for the installation of one or two armored fiber cables. To install two cables in partially occupied communications conduit, however, the cables must be attached to each other and pulled through the conduit simultaneously due to practical difficulties associated with

pulling them separately given the limited space. To provide infrastructure that could be used by all classes of customers, it would be advantageous to have two cables with high fiber counts (96 - 144 fibers per cable), with one cable dedicated to the traffic of the most demanding users (i.e., large businesses, smaller businesses with a very high demand for information throughput, the City, and Utilities) and the other cable dedicated to residents and small businesses.

C.3. Definition of Strategies

As shown in Table C2, eight strategies were defined and quantitatively evaluated in Phase 4, with two strategies involving only existing infrastructure and six strategies requiring the development of new infrastructure. The six infrastructure development strategies were defined specifically for the purpose of incremental evaluation, whereby additional infrastructure is added to one strategy to create a second strategy, additional infrastructure is added to the second strategy to create a third strategy, etc.

General Strategies	Key Elements Used to Define Specific Strategies				Specific Strategies Evaluated
	Contractual Requirements for Offering Residential Service?	New Infrastructure Developed in Palo Alto by the City (and Partner, if any)			
		Number of Fiber Cables in Backbone Ring	Infrastructure for Residents and Small Businesses	Infrastructure for Large Businesses & Other High Demand Customers	
Lease Existing Infrastructure	No	***Zero***			Strategy 1
	Yes				Strategy 2
Develop a Network and Lease Access		***One***	None	DFB	Strategy 3
				CAP	Strategy 4
		Two	Co-op	DFB	Strategy 5
				CAP	Strategy 6
			New HFC	DFB	Strategy 7
				CAP	Strategy 8

DFB = Dark Fiber Backbone
CAP = Competitive Access Provider Network
Co-op = Dark Fiber Extensions used by Cable Co-op to Upgrade their Infrastructure to a HFC Network
New HFC = New Hybrid Fiber-Coax Network

Table C2 - Summary of Strategies Quantitatively Evaluated in Phase 4

For the six network development strategies, the costs of developing the necessary distribution network infrastructure are summarized in Table C3. The detailed spreadsheets from which these construction costs were derived are presented as Tables C4 and C5.

Incremental Cost Components	Network Development Strategy Number					
	3	4	5	6	7	8
Residential and Small Business Infrastructure						
Fiber Parallel to Primary Ring			$833	$833	$833	$833
Fiber Extensions to HFC Nodes			$1,234	$1,234	$1,234	$1,234
HFC Nodes					$1,266	$1,266
Coaxial Cable Plant					$7,278	$7,278
Coaxial Cable Drops					$1,214	$1,214
Large Businesses Infrastructure						
Primary Fiber Ring	$676	$676	$676	$676	$676	$676
Secondary Fiber Ring		$365		$365		$365
Fiber Laterals to Customers		$829		$829		$829
SONET Hubs (Electronics)		$918		$918		$918
Total Construction Cost	$646	$2,788	$2,743	$4,855	$12,500	$14,612

Table C3 - Summary of Estimated Distribution Network Construction Costs, $1000s

Each of these strategies are described below. Note that with each strategy, although not explicitly quantified, it is assumed that the City could lease additional conduit or pole space to others upon request on an as-available basis.

Strategies Involving Only Existing Infrastructure:

1. **Lease Existing Infrastructure with Minimal Requirements** - The City leases an estimated 20 miles of conduit and pole space to a single competitive access provider (CAP) that will install primary and secondary fiber rings with the intent of serving Palo Alto's major business districts. The City requires 8 fibers to be reserved in the primary ring, at no charge, for the City's internal use. Since much of the conduit and pole space will be shared with existing Utilities communications lines, the CAP must agree to joint access terms established by the City.

2. **Lease Existing Infrastructure with Residential Service Requirements** - The City leases an estimated 150 miles of conduit and pole space to a single telecommunications network developer (TND) that agrees to make services available to all businesses and residents in geographically accessible locations in Palo Alto by a specified date. The City requires 8 fibers to be reserved in the TND's primary fiber ring, at no charge, for the City's internal use. Since some of the conduit and pole space will be shared with existing Utilities communications lines, the TND must agree to joint access terms established by the City. The TND also must provide assurances that guarantee residential service availability.

Table C4
Estimated Distribution Network Construction Costs for Network Development Strategies

Network Cost Element	CAP Network Cost Elements				HFC Network Cost Elements					Totals
	Primary Fiber Ring	Secondary Fiber Rings	Fiber Laterals for CAP Services (100 Cust.)	SONET Hubs	Fiber Parallel to Primary Fiber Ring	Fiber Extensions to HFC Nodes	HFC Nodes	Coax Plant	Coax Drops (50% of Homes & Bus. Passed)	
Miles of Plant	15.0	10.0	7.6		15.0	42		175.0	265.2	529.7
Percent of Plant Overhead	30%	0%	0%		0.3	80%		80%	80%	
% of Underground Plant in Existing Conduit	100%	80%	0%		1.0	25%		0%	0%	
Miles of Overhead Plant	4.5	0.0	0.0		4.5	33.6		140.0	212.1	394.7
Miles of Underground Plant in Existing Conduit	10.5	8.0	0.0		10.5	2.1		0.0	0.0	31.1
Miles of Underground Plant in New Conduit	0.0	2.0	7.6		0.0	6.3		35.0	53.0	103.9
Fiber Strands per Cable	96	24	4		144	4				
Cabling Costs										
Fiber Cost	$ 532,224	$ 88,704	$ 11,200		$ 798,336	$ 62,093		$ -	$ -	$ 1,492,557
Fiber Sheath Cost	$ 19,800	$ 13,200	$ 10,000		$ 19,800	$ 55,440		$ -	$ -	$ 118,240
Coaxial Cable Cost	$ -	$ -	$ -		$ -	$ -		$ 693,000	$ 280,000	$ 973,000
Overhead Labor Cost	$ 47,520	$ -	$ -		$ -	$ 354,816		$ 1,108,800	$ 560,000	$ 2,071,136
Pole Make-Ready Cost	$ 5,940	$ -	$ -		$ -	$ 44,352		$ 184,800	$ -	$ 235,092
Underground Pull Cost	$ 55,440	$ 42,240	$ -		$ -	$ 11,088		$ -	$ -	$ 108,768
New Underground Labor Cost	$ -	$ 179,520	$ 680,000		$ -	$ 565,488		$ 3,141,600	$ 364,000	$ 4,930,608
New Conduit Cost	$ -	$ 31,680	$ 120,000		$ -	$ 99,792		$ 646,800	$ -	$ 898,272
Total Estimated Cabling Cost	$ 660,924	$ 355,344	$ 821,200		$ 818,136	$ 1,193,069		$ 5,775,000	$ 1,204,000	$10,827,673
Equipment Costs										
OC-48 SONET Hubs (3)				$ 456,000						$ 456,000
OC-12 SONET Hubs (6)				$ 462,000						$ 462,000
HFC Nodes (51)							$ 1,265,600			$ 1,265,600
Coax Amplifiers, Taps, and Connectors								$ 882,656	$ 9,800	$ 892,456
Fixed Network Costs										
Design Services	$ 9,504	$ 6,336	$ 4,800		$ 9,504	$ 26,611		$ 110,880		$ 167,635
Traffic Control & Other	$ 5,250	$ 3,500	$ 2,652		$ 5,250	$ 14,700		$ 61,250		$ 92,602
Other Miscellaneous Costs										
Damage Claims								$ 140,000		$ 140,000
Insurance Premiums								$ 140,000		$ 140,000
Bond Premiums								$ 140,000		$ 140,000
Publications								$ 28,000		$ 28,000
Estimated Total Cost	$ 675,678	$ 365,180	$ 828,652	$ 918,000	$ 832,890	$ 1,234,380	$ 1,265,600	$ 7,277,786	$ 1,213,800	$14,611,966

Network Alternatives	Construction Cost	
Dark Fiber Backbone	$ 675,678	
Competitive Access Provider	$ 2,787,510	(includes installation of fiber laterals to 100 CAP customers)
Dark Fiber Backbone + Extensions to Co-op HFC Nodes	$ 2,742,948	
CAP Network + Extensions to Co-op HFC Nodes	$ 4,854,780	(includes installation of fiber laterals to 100 CAP customers)
Dark Fiber Backbone + HFC Network	$ 12,500,134	
Cost of CAP Network + HFC Network	$ 14,611,966	(includes installation of fiber laterals to 100 CAP customers and drops to 14,000 (50% of the potential) HFC customers)

Table C5

Network Construction Cost Estimating Assumptions

Source: Media Connections Group, May 1996

General Network Design Assumptions	
Number of Homes in Palo Alto	25,500
Number of Candidate Businesses in Palo Alto	2,500
Number of Homes & Businesses Passed	28,000
Avg. Number of Homes & Bus. per HFC Nod	500
Number of HFC Nodes	56
Average CAP Fiber Lateral Distance, Feet	400
Number of CAP Customers	100
Avg. Length per Fiber Ext. to HFC Nodes, mil	0.75
Avg. No. of Homes & Bus. Passed per Mile	160
Average Drop Length, feet	100

Fiber Plant - Cabling Cost Assumptions		
Fiber Cost, $/Foot	$	0.07
Sheath Cost, $/Foot	$	0.25
Overhead Labor, $/ft	$	2.00
Pole Make-Ready Cost (Fiber), $/ft	$	0.25
Underground Pull Cost, $/ft	$	1.00
New Underground Labor Cost, $/ft	$	17.00
New Underground Conduit, $/ft	$	3.00

Coax Plant - Cabling Cost Assumptions		
Cost of Cable, Strand, Etc., $/ft	$	0.75
Overhead Labor, $/ft	$	1.50
Pole Make-Ready Cost (Coax), $/ft	$	0.25
Coax Pull Cost, $/ft	$	1.00
Underground Labor, $/ft	$	17.00
Conduit & Pedestal Cost, $/ft	$	3.50

Coax Drops - Cabling Cost Assumptions		
Drop Penetration, % of Homes		50%
Coax Drops, $/ft	$	0.20
Installation Labor, $/install	$	25.00
Drop Bury Cost, $/install	$	40.00

OC-48 SONET Hub Costs (2.4 Gbps)		
Number of Hubs		3
Number of FO Xmitters/hub		0
Number of FO Receivers/hub		0
Optical Xmitters, $/hub	$	10,000
Optical Receivers, $/hub	$	3,500
SONET Eqpt. Pack, $/hub	$	125,000
SONET Misc. Eqpt., $/hub	$	5,000
Power Supply, $/hub	$	5,000
Housing, $/hub	$	5,000
Installation Labor, $/hub	$	12,000
Real Estate Purchase, $/hub	$	-
Estimated Total Cost	$	456,000

OC-12 SONET Hub Costs (633 Mbps)		
Number of Hubs		6
Number of FO Xmitters/hub		0
Number of FO Receivers/hub		0
Optical Xmitters, $/hub	$	5,000
Optical Receivers, $/hub	$	3,500
SONET Eqpt. Pack, $/hub	$	50,000
SONET Misc. Eqpt., $/hub	$	5,000
Power Supply, $/hub	$	5,000
Housing, $/hub	$	5,000
Installation Labor, $/hub	$	12,000
Real Estate Purchase, $/hub	$	-
Estimated Total Cost	$	462,000

HFC Node Costs		
Number of Nodes		56
Downstream FO Transmitter, $/node	$	10,500
Downstream FO Receiver, $/node	$	1,500
Upstream FO Transmitter, $/node	$	7,500
Upstream FO Receiver, $/node	$	1,000
Power Supplies, $/node	$	2,100
Estimated Total Cost	$	1,265,600

Coax Plant Equipment Cost		
Estimated Density, homes & bus./mile		160
Total Homes & Businesses Passed		28,000
Number of Coax Miles		175
No. of Active Amplifiers per Mile		5
Avg. No. of Homes per Tap		3.2
Avg. No. of Connectors per Amplifier		2.5
Cost per Active (2-way)	$	800.00
Cost of Taps (power passing), $/unit	$	20.00
Cost of Connectors, $/unit	$	3.50
Amplifier Cost	$	700,000
Tap Costs	$	175,000
Connector Costs	$	7,656
Estimated Total Cost	$	882,656

Coax Drop Connector Costs		
Drop Penetration, % of Homes		50%
Number of Drops		14,000
No. of Connectors per Drop		2
Cost of Connectors, $/install	$	0.35
Estimated Total Cost	$	9,800

Fixed Network Costs		
Designers Labor, $/ft	$	0.10
Design Production Cost, $/ft	$	0.02
Traffic Control Cost, $/mile	$	100.00
Other Fixed Costs, $/mile	$	250.00

Other Miscellaneous Costs		
Damage Claims, $/HP	$	5.00
Insurance Premiums, $/HP	$	5.00
Bond Premiums, $/HP	$	5.00
Publication Costs, $/HP	$	1.00

Strategies Requiring the Development of New Infrastructure

3. **Dark Fiber Backbone** - The City co-locates a fiber cable in conduit and on poles with existing Utilities' communications lines to create a 15-mile, 96-fiber primary ring. The City reserves 8 fibers in the primary ring for internal use and leases the remainder to interested companies, such as competitive access providers.

4. **CAP Network** - The City co-locates a fiber cable in conduit and on poles with existing Utilities' communications lines to create a fiber backbone consisting of a 15-mile, 96-fiber primary ring and 10 miles of 24-fiber secondary rings that pass through major districts. The City reserves 8 fibers in the primary ring for internal use. The City provisions other fibers in the backbone with SONET[1] hubs and develops new underground fiber laterals that extend from the backbone to the premises of major telecommunications users as they are demanded.

5. **Dark Fiber Backbone with Dark Fiber Extensions for Cable Co-op** - The City co-locates two fiber cables with existing Utilities communications lines to develop a Dark Fiber Backbone (DFB), as described in Strategy 3, in conjunction with the backbone for a separate network of dark fiber that is designed to connect Cable Co-op's headend[2] with the future locations of Hybrid Fiber-Coax (HFC) nodes to be installed by Cable Co-op.

   The HFC nodes are the points at which the optical signals carried on fiber are converted to (from) electrical signals which are carried from (to) the nodes to (from) customer premises on coaxial cables. Fiber is extended between Cable Co-op's headend and an estimated 56 nodes throughout Palo Alto. For each node, a unique set of 4 fibers run parallel to the primary ring of the DFB and are spliced to four fibers that connect to the actual node site.

   The fibers for Cable Co-op's HFC nodes that run parallel to the DFB are contained in separate cable from the DFB cable. This separate cable contains 144 fibers. The two cables are attached to each other by the manufacturer and installed simultaneously. It is assumed that the DFB fibers are used by one or more CAPs to serve major telecommunications users (primarily large businesses) and the fibers for the HFC network are used by Cable Co-op for residential and small business customers.

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[1]Synchronous Optical Network (SONET) is a standard that has been developed for the electronics that manage the flow of digital information over optical telecommunications networks.

[2]Cable Co-op's headend is located near 3200 Park Boulevard. It is the central point of a coaxial cable or hybrid fiber-coax network from (to) which all signals flow.

6. **CAP Network with Dark Fiber Extensions for Cable Co-op** - The City co-locates two fiber cables with existing Utilities communications lines to develop a CAP Network, as described in Strategy 4, in conjunction with a separate network of dark fiber extensions for the future locations of Cable Co-op's Hybrid Fiber-Coax (HFC) nodes, similar to the difference between Strategy 3 and Strategy 5.

7. **Dark Fiber Backbone and HFC[3] Network** - The City co-locates two fiber cables with existing Utilities communications lines to develop a Dark Fiber Backbone in conjunction with a separate network of fiber extensions for the future locations of Hybrid Fiber-Coax (HFC) nodes, similar to Strategy 5. In this strategy, however, the HFC network will be owned and operated by the City (and a partner) without using any of Cable Co-op's infrastructure. The City develops 56 HFC nodes, a network of coaxial cable distribution lines serving 500 homes and small businesses per HFC node, and coaxial cable drops connecting the coaxial cable distribution lines to customer premises. The headend is assumed to be located at the Municipal Service Center. The HFC network modeled is capable of carrying video, data, and lifeline voice services.

8. **CAP Network and HFC[3] Network** - The City co-locates two fiber cables with existing Utilities communications lines to develop a CAP Network in conjunction with a separate network of fiber extensions for the future locations of Hybrid Fiber-Coax (HFC) nodes, similar to Strategy 6. In this strategy, however, the City constructs an HFC network, as in Strategy 7, and does not use any of Cable Co-op's infrastructure.

C.4. Nominal Case Financial Models

Tables C6 - C13 present the detailed financial models that were prepared for each strategy using nominal case assumptions for all variables. The net present value (NPV) of net cash flow over a ten year period was used as the bottom line measure of performance for alternatives. To account for differences across strategies in the remaining value of the new infrastructure developed and the balances on outstanding debt at the end of the ten year period, a residual value analysis was used. In this analysis, at the end of year 10, the business was assumed to be sold at a multiple of operating cash flow (four times operating cash flow in the nominal case) and any remaining debts were paid in full.

Tables C14 and C15 present the basis for some costs specified in Tables C6-C13. Table C14 details avoided costs for a Utilities fiber ring with 8 fibers for internal use. Table C15 presents the cost assumptions for HFC headend equipment for Strategies 7 and 8.

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[3]Note that residential and small business access architectures other than HFC are possible (e.g., fiber to the home) but have higher initial costs. HFC was chosen for the quantitative analysis because it has a relatively low initial cost and it lends itself to the incremental evaluation approach described above. This is not meant to imply that other access architectures should be removed from further consideration in the future.

Table C6
NOMINAL CASE FINANCIAL MODEL
Strategy 1 - Lease Existing Infrastructure with Minimal Requirements

Miles Leased	20
% Overhead	20%
Overhead Rate, $ / Pole-Year	$ 6.00
Pole Spacing, Average Feet Between Poles	150
Conduit Lease Rate, $ / Foot-Year	$ 6.00
Anticipated Utilities Fiber Installation, years	7

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Annual Income (1996 Dollars)										
Pole Lease Revenues	$ 422	$ 845	$ 845	$ 845	$ 845	$ 845	$ 845	$ 845	$ 845	$ 845
Conduit Lease Revenues	$ 253,440	$ 506,880	$ 506,880	$ 506,880	$ 506,880	$ 506,880	$ 506,880	$ 506,880	$ 506,880	$ 506,880
Total Revenues	$ 253,862	$ 507,725	$ 507,725	$ 507,725	$ 507,725	$ 507,725	$ 507,725	$ 507,725	$ 507,725	$ 507,725
Annual Expenses (1996 Dollars)										
Personnel Costs										
Salaries [1]	$ 100,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Benefits (33%)	$ 33,000	$ 4,950	$ 4,950	$ 4,950	$ 4,950	$ 4,950	$ 4,950	$ 4,950	$ 4,950	$ 4,950
Total Costs	$ 133,000	$ 19,950	$ 19,950	$ 19,950	$ 19,950	$ 19,950	$ 19,950	$ 19,950	$ 19,950	$ 19,950
Cash Flow (1996 Dollars)	$ 120,862	$ 487,775	$ 487,775	$ 487,775	$ 487,775	$ 487,775	$ 487,775	$ 487,775	$ 487,775	$ 487,775
Cash Flow (Current Dollars) [2]	$ 120,862	$ 507,286	$ 527,577	$ 548,680	$ 570,628	$ 593,453	$ 617,191	$ 641,878	$ 667,553	$ 694,256
Electric Utility Financial Involvement (Current Dollars)										
Repayment of all Telecom Study Costs	$ (200,000)									
Avoided Utilities Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ 237,635	$ -	$ -	$ -
Startup Loan (from Utility Reserves)										
Balance at Start of Year	$ -	$ 83,886	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
New Loan Amount (Start of Year)	$ 79,138	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest (6%)	$ 4,748	$ 5,033	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Loan Payments	$ -	$ (88,919)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow (Current Dollars)	$ -	$ 418,367	$ 527,577	$ 548,680	$ 570,628	$ 593,453	$ 854,825	$ 641,878	$ 667,553	$ 694,256

NPV of Net Cash Flow (10 yr. @ 6%) $ 4,079,627

Notes

[1] Staffing in year 1 covers contract negotiation and development and project oversight; staffing thereafter covers contract management.

[2] A 4% inflation rate was assumed to escalate Constant (1996) Dollar net cash flows to Current Dollar net cash flows.

Table C7
NOMINAL CASE FINANCIAL MODEL
Strategy 2 - Lease Existing Infrastructure with Residential Service Requirements

Miles Leased		150
% Overhead		70%
Overhead Rate, $ / Pole-Year	$	4.00
Pole Spacing, Average Feet Between Poles		150
Conduit Lease Rate, $ / Foot-Year	$	3.00
Anticipated Utilities Fiber Installation, years		7

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Annual Income (1996 Dollars)										
Pole Lease Revenues		$ 14,784	$ 14,784	$ 14,784	$ 14,784	$ 14,784	$ 14,784	$ 14,784	$ 14,784	$ 14,784
Conduit Lease Revenues		$ 712,800	$ 712,800	$ 712,800	$ 712,800	$ 712,800	$ 712,800	$ 712,800	$ 712,800	$ 712,800
Total Revenues	$ -	$ 727,584	$ 727,584	$ 727,584	$ 727,584	$ 727,584	$ 727,584	$ 727,584	$ 727,584	$ 727,584
Annual Expenses (1996 Dollars)										
Personnel Costs										
Salaries [1]	$ 200,000	$ 150,000	$ 100,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000
Benefits (33%)	$ 66,000	$ 49,500	$ 33,000	$ 16,500	$ 16,500	$ 16,500	$ 16,500	$ 16,500	$ 16,500	$ 16,500
Total Costs	$ 266,000	$ 199,500	$ 133,000	$ 66,500	$ 66,500	$ 66,500	$ 66,500	$ 66,500	$ 66,500	$ 66,500
Cash Flow (1996 Dollars)	$ (266,000)	$ 528,084	$ 594,584	$ 661,084	$ 661,084	$ 661,084	$ 661,084	$ 661,084	$ 661,084	$ 661,084
Cash Flow (Current Dollars) [2]	$ (266,000)	$ 549,207	$ 643,102	$ 743,630	$ 773,375	$ 804,310	$ 836,482	$ 869,941	$ 904,739	$ 940,929
Electric Utility Financial Involvement (Current Dollars)										
Repayment of all Telecom Study Costs	$ (200,000)									
Avoided Utilities Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ 237,635	$ -	$ -	$ -
Startup Loan (from Utility Reserves)										
Balance at Start of Year	$ -	$ 493,960	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Loan Amount (Start of Year)	$ 466,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest (6%)	$ 27,960	$ 29,638	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Loan Payments	$ -	$ (523,598)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow (Current Dollars)	$ -	$ 25,610	$ 643,102	$ 743,630	$ 773,375	$ 804,310	$ 1,074,117	$ 869,941	$ 904,739	$ 940,929

NPV of Net Cash Flow (10 yr. @ 6%) $ 4,894,846

Notes

[1] Anticipates higher personnel costs than Leasing Existing Infrastructure with Minimal Requirements due to contract complexity and the need to verify that contract requirements are met.

[2] A 4% inflation rate was assumed to escalate Constant (1996) Dollar net cash flows to Current Dollar net cash flows.

Table C8 (Page 1 of 2)
NOMINAL CASE FINANCIAL MODEL
Strategy 3 - Dark Fiber Backbone

Primary Ring Fibers Available for Lease	88
Length per Primary Ring Fiber, miles	15
Total Fiber-Miles Available for Lease	1320
Lease Rate, $/fiber-mile-yr	$ 1,500
Peak Leased Fiber-Miles, Percent of Total	50%
Yrs. of Growth to Peak Leased Fiber-Miles	3
Anticipated Utilities Fiber Installation, years	7
Asset Value, Multiple of Operating Cash Flow	4

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Annual Income (1996 Dollars)										
Percent of Fibers Leased	0%	17%	33%	50%	50%	50%	50%	50%	50%	50%
Total Revenues	$ -	$ 330,000	$ 660,000	$ 990,000	$ 990,000	$ 990,000	$ 990,000	$ 990,000	$ 990,000	$ 990,000
Annual Expenses (1996 Dollars)										
Construction Costs										
Primary Fiber Ring	$ 675,678	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Other Network Costs										
Maintenance Vehicles [1]	$ 25,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Equipment [2]	$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Equipment Replacement Costs [3]	$ -	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Building Space Leased from City	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000
Personnel Costs										
Salaries [4]	$ 150,000	$ 140,000	$ 140,000	$ 140,000	$ 140,000	$ 140,000	$ 140,000	$ 140,000	$ 140,000	$ 140,000
Benefits (33%)	$ 49,500	$ 46,200	$ 46,200	$ 46,200	$ 46,200	$ 46,200	$ 46,200	$ 46,200	$ 46,200	$ 46,200
Training / Technical Support (3%)	$ 4,500	$ 4,200	$ 4,200	$ 4,200	$ 4,200	$ 4,200	$ 4,200	$ 4,200	$ 4,200	$ 4,200
Total Costs	$ 958,678	$ 209,400	$ 209,400	$ 209,400	$ 209,400	$ 209,400	$ 209,400	$ 209,400	$ 209,400	$ 209,400
Cash Flow (1996 Dollars)	$ (958,678)	$ 120,600	$ 450,600	$ 780,600	$ 780,600	$ 780,600	$ 780,600	$ 780,600	$ 780,600	$ 780,600
Cash Flow (Current Dollars) [5]	$ (958,678)	$ 125,424	$ 487,369	$ 878,069	$ 913,192	$ 949,719	$ 987,708	$ 1,027,216	$ 1,068,305	$ 1,111,037
Electric Utility Financial Involvement (Current Dollars)										
Repayment of all Telecom Study Costs	$ (200,000)									
Avoided Utilities Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ 237,635	$ -	$ -	$ -

Table C8 (Page 2 of 2)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Startup Loan (from Utility Reserves)										
Balance at Start of Year	$ -	$ 1,228,199	$ 1,176,467	$ 759,686	$ -	$ -	$ -	$ -	$ -	$ -
Loan Amount (Start of Year)	$ 1,158,678	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest (6%)	$ 69,521	$ 73,692	$ 70,588	$ 45,581	$ -	$ -	$ -	$ -	$ -	$ -
Loan Payments	$ -	$ (125,424)	$ (487,369)	$ (805,267)	$ -	$ -	$ -	$ -	$ -	$ -
Residual Value of Assets (Current Dollars)										
Sale of Assets [6]										$ 4,529,548
Retirement of Outstanding Debt										$ -
Net Cash Flow (Current Dollars)	$ -	$ -	$ -	$ 72,802	$ 913,192	$ 949,719	$ 1,225,343	$ 1,027,216	$ 1,068,305	$ 5,640,585
NPV of Net Cash Flow (10 yr. @ 6%)	$ 7,050,042									

Notes

[1] Assumes 1 equipped pickup truck at $25,000 and 1 bucket truck available from Utilities for limited usage at no charge.

[2] OTDR test equipment at $10,000 and a fusion splicer at $40,000.

[3] Assumed to be 20% of total capital equipment, not including fiber infrastructure.

[4] Costs cover 1 manager ($70,000/yr) and 1 fiber technician ($50,000/yr starting in Year 2). Additional costs cover misc. cross-departmental charges.

[5] A 4% inflation rate was assumed to escalate Constant (1996) Dollar net cash flows to Current Dollar net cash flows.

[6] All assets purchased in Years 1-10 are assumed to be sold at the end of Year 10 for a multiple of operating cash flow (defined as the difference between revenue and all expenses before capital, interest, depreciation, and taxes) to account for the remaining value of newly developed assets. Although telecommunications network such as cable television historically sold at 7 to 12 times operating cash flow, a multiple of 4 was conservatively assumed to account for the fact that the network will not be a quasi-monopoly, will not have market dominance, and will face multiple well-financed, virtually unregulated competitors. Also, the assumed growth of the media businesses has strongly influenced their market values. The growth rate of this pure transport business will likely have far less appeal, especially by the year 2007. Finally, the fiber will be located in conduits shared with the Electric Utility and, as a result, would be assessed a lower value than fibers in a discrete network.

Table C9 (Page 1 of 2)
NOMINAL CASE FINANCIAL MODEL
Strategy 4 - Competitive Access Provider Network

Network Capacity		2,400 Mbps
Max Number of T1s on Network [1]		1,600
Peak Number of T1+ Customers [1]		100
Yrs. of Growth to Peak No. of Customers		4
Average Number of T1s per Customer [1]		5
Pac Bell's Current Avg. Monthly T1 Rate	$	430
Pac Bell's Near Future T1 Rate Reduction		20%
City's Discount off Pac Bell's Current Rate		25%
City's Average Monthly T1 Rate	$	323
Anticipated Utilities Fiber Installation, years		7
Asset Value, Multiple of Operating Cash Flow		4

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Annual Income (1996 Dollars)										
Number of CAP Customers	0	25	50	75	100	100	100	100	100	100
Number of T1s Leased	0	125	250	375	500	500	500	500	500	500
Total Revenues	$ -	$ 483,750	$ 967,500	$ 1,451,250	$ 1,935,000	$ 1,935,000	$ 1,935,000	$ 1,935,000	$ 1,935,000	$ 1,935,000
Annual Expenses (1996 Dollars)										
Construction Costs										
Primary Fiber RIng	$ 675,678	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Secondary Fiber Rings	$ 365,180	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
SONET Hubs	$ 918,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Other Network Costs										
CAP Network Control Center	$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Vehicles [2]	$ 75,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Equipment [3]	$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Plant Equipment Replacement Costs [4]	$ -	$ 218,600	$ 218,600	$ 218,600	$ 218,600	$ 218,600	$ 218,600	$ 218,600	$ 218,600	$ 218,600
Building Space Leased from City	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000
Powering Costs	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
New Customer Hookup Costs										
Fiber Laterals	$ -	$ 207,163	$ 207,163	$ 207,163	$ 207,163	$ -	$ -	$ -	$ -	$ -
Additional SONET Eqpt. Packs [5]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Personnel Costs										
Salaries [6]	$ 160,000	$ 435,000	$ 435,000	$ 435,000	$ 435,000	$ 435,000	$ 435,000	$ 435,000	$ 435,000	$ 435,000
Benefits (33%)	$ 52,800	$ 143,550	$ 143,550	$ 143,550	$ 143,550	$ 143,550	$ 143,550	$ 143,550	$ 143,550	$ 143,550
Training / Technical Support (3%)	$ 4,800	$ 13,050	$ 13,050	$ 13,050	$ 13,050	$ 13,050	$ 13,050	$ 13,050	$ 13,050	$ 13,050
Total Costs	$ 2,386,458	$ 1,052,363	$ 1,052,363	$ 1,052,363	$ 1,052,363	$ 845,200	$ 845,200	$ 845,200	$ 845,200	$ 845,200
Cash Flow (1996 Dollars)	$ (2,386,458)	$ (568,613)	$ (84,863)	$ 398,887	$ 882,637	$ 1,089,800	$ 1,089,800	$ 1,089,800	$ 1,089,800	$ 1,089,800

Table C9 (Page 2 of 2)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Cash Flow (Current Dollars) [7]	$ (2,386,458)	$ (591,357)	$ (91,788)	$ 448,694	$ 1,032,561	$ 1,325,908	$ 1,378,945	$ 1,434,102	$ 1,491,467	$ 1,551,125
Electric Utility Financial Involvement (Current Dollars)										
Repayment of all Telecom Study Costs	$ (200,000)									
Avoided Utilities Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ 237,635	$ -	$ -	$ -
Startup Loan (from Utility Reserves)										
Balance at Start of Year	$ -	$ 2,741,645	$ 3,532,983	$ 3,842,257	$ 3,624,099	$ 2,808,984	$ 1,651,615	$ 134,132	$ -	$ -
Loan Amount (Start of Year)	$ 2,586,458	$ 591,357	$ 91,788	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest (6%)	$ 155,187	$ 199,980	$ 217,486	$ 230,535	$ 217,446	$ 168,539	$ 99,097	$ 8,048	$ -	$ -
Loan Payments	$ -	$ -	$ -	$ (448,694)	$ (1,032,561)	$ (1,325,908)	$ (1,616,579)	$ (142,180)	$ -	$ -
Residual Value of Assets (Current Dollars)										
Sale of Assets [8]										$ 7,449,045
Retirement of Outstanding Debt										$ -
Net Cash Flow (Current Dollars)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,291,922	$ 1,491,467	$ 9,000,170
NPV of Net Cash Flow (10 yr. @ 6%)	$ 7,122,153									

Notes

[1] Although the CAP network will be capable of supporting a variety signals (DS1, DS3, OC-1, OC-3, OC-12), T1 (i.e., DS-1) is used as a basic unit of measure. This is not intended to imply that only T1 services will be supported. The transported signals may include DS-1 = 1.544 Mbps, DS-3 = 44.736 Mbps, OC-1 = 51.84 Mbps, OC-3 = 155.52 Mbps, and/or OC-12 = 622.08 Mbps. It is anticipated that bandwidth demand per customer will increase over time, but that this will be offset by a decrease in the average size of customers that use CAP services.

[2] Assumes 3 equipped pickup trucks at $25,000 each and 1 bucket truck available from Utilities for limited usage at no charge.

[3] OTDR test equipment at $10,000 and a fusion splicer at $40,000.

[4] Assumed to be 20% of total capital equipment, not including fiber infrastructure.

[5] Initial SONET hubs equipped at 50% capacity. If demand > 50% capacity, remaining hub capacity filled with SONET eqpt. packs.

[6] Assumes $150,000 in Year 1 for construction management, marketing, and contract negotiation and management, and $50,000 thereafter plus 7 staff at an average of $50,000 per year.

[7] A 4% inflation rate was assumed to escalate Constant (1996) Dollar net cash flows to Current Dollar net cash flows.

[8] All assets purchased in Years 1-10 are assumed to be sold at the end of Year 10 for a multiple of operating cash flow (defined as the difference between revenue and all expenses before capital, interest, depreciation, and taxes) to account for the remaining value of newly developed assets. Although telecommunications network such as cable television historically sold at 7 to 12 times operating cash flow, a multiple of 4 was conservatively assumed to account for the fact that the network will not be a quasi-monopoly, will not have market dominance, and will face multiple well-financed, virtually unregulated competitors. Also, the assumed growth of the media businesses has strongly influenced their market values. The growth rate of this pure transport business will likely have far less appeal, especially by the year 2007. Finally, the fiber will be located in conduits shared with the Electric Utility and, as a result, would be assessed a lower value than fibers in a discrete network.

Table C10 (Page 1 of 2)
NOMINAL CASE FINANCIAL MODEL
Strategy 5 - Dark Fiber Backbone with Fiber Extensions for Cable Co-op's HFC Network

DFB Lease Assumptions	
Primary Ring Fibers Available for Lease	88
Length per Primary Ring Fiber, miles	15
Total Fiber-Miles Available for Lease	1,320
Dark Fiber Lease Rate, $/fiber-mile-year	$ 1,500
Peak Leased Fiber-Miles, Percent of Total	50%
Yrs. of Growth to Peak Leased Fiber-Miles	3
Anticipated Utilities Fiber Installation, years	7
Asset Value, Multiple of Operating Cash Flow	4

Co-op Fiber Lease Assumptions	
Number of Nodes	56
Fibers per Node	4
Avg. Primary Ring Miles / Node	3.75
Avg. Extension Miles / Node	0.75
Miles of Fiber Leased	1,008
Dark Fiber Lease Rate, $/fiber-mile-year	$ 1,500
- Equiv. $/mo. per Home & Bus. Passed	$ 4.50
Percent Leased in Year 2 (100% afterwards)	50%
Duration of Lease Payments, Years	10

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Annual Income (1996 Dollars)										
Percent of DFB Fibers Leased	0%	17%	33%	50%	50%	50%	50%	50%	50%	50%
Total DFB Lease Revenues	$ -	$ 330,000	$ 660,000	$ 990,000	$ 990,000	$ 990,000	$ 990,000	$ 990,000	$ 990,000	$ 990,000
Co-op Fiber Extension Revenues		$ 756,000	$ 1,512,000	$ 1,512,000	$ 1,512,000	$ 1,512,000	$ 1,512,000	$ 1,512,000	$ 1,512,000	$ 1,512,000
Total Revenues	$ -	$ 1,086,000	$ 2,172,000	$ 2,502,000	$ 2,502,000	$ 2,502,000	$ 2,502,000	$ 2,502,000	$ 2,502,000	$ 2,502,000
Annual Expenses (1996 Dollars)										
Construction Costs [1]										
Primary Fiber Ring	$ 675,678	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
HFC Fiber Parallel to Primary Fiber RIng	$ 832,890	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fiber Extensions to HFC Nodes	$ 822,920	$ 411,460	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Other Network Costs										
Maintenance Vehicles [2]	$ 67,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Equipment [3]	$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Equipment Replacement Costs [4]	$ -	$ 23,500	$ 23,500	$ 23,500	$ 23,500	$ 23,500	$ 23,500	$ 23,500	$ 23,500	$ 23,500
Building Space Leased from City	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
Personnel Costs										
Salaries [5]	$ 200,000	$ 220,000	$ 195,000	$ 195,000	$ 195,000	$ 195,000	$ 195,000	$ 195,000	$ 195,000	$ 195,000
Benefits (33%)	$ 66,000	$ 72,600	$ 64,350	$ 64,350	$ 64,350	$ 64,350	$ 64,350	$ 64,350	$ 64,350	$ 64,350
Training / Technical Support (3%)	$ 6,000	$ 6,600	$ 5,850	$ 5,850	$ 5,850	$ 5,850	$ 5,850	$ 5,850	$ 5,850	$ 5,850
Total Costs	$ 2,730,988	$ 744,160	$ 298,700	$ 298,700	$ 298,700	$ 298,700	$ 298,700	$ 298,700	$ 298,700	$ 298,700
Cash Flow (1996 Dollars)	$ (2,730,988)	$ 341,840	$ 1,873,300	$ 2,203,300	$ 2,203,300	$ 2,203,300	$ 2,203,300	$ 2,203,300	$ 2,203,300	$ 2,203,300
Cash Flow (Current Dollars) [6]	$ (2,730,988)	$ 355,514	$ 2,026,161	$ 2,478,413	$ 2,577,549	$ 2,680,651	$ 2,787,877	$ 2,899,392	$ 3,015,368	$ 3,135,983

Table C10 (Page 2 of 2)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Annual Income (1996 Dollars)										
Repayment of all Telecom Study Costs	$ (200,000)									
Avoided Utilities Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ 237,635	$ -	$ -	$ -
Startup Loan (from Utility Reserves)										
Balance at Start of Year	$ -	$ 3,106,847	$ 2,937,745	$ 1,087,848	$ -	$ -	$ -	$ -	$ -	$ -
Loan Amount (Start of Year)	$ 2,930,988	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest (6%)	$ 175,859	$ 186,411	$ 176,265	$ 65,271	$ -	$ -	$ -	$ -	$ -	$ -
Loan Payments	$ -	$ (355,514)	$ (2,026,161)	$ (1,153,119)	$ -	$ -	$ -	$ -	$ -	$ -
Residual Value of Assets (Current Dollars)										
Sale of Assets [7]										$ 12,677,723
Retirement of Outstanding Debt										$ -
Net Cash Flow (Current Dollars)	$ -	$ -	$ -	$ 1,325,294	$ 2,577,549	$ 2,680,651	$ 3,025,512	$ 2,899,392	$ 3,015,368	$ 15,813,706
NPV of Net Cash Flow (10 yr. @ 6%)	$ 20,470,657									

Notes

[1] Construction buildout schedule: Fiber rings -- 100% in Year 1; Fiber extensions to HFC nodes -- 2/3 in Year 1, 1/3 in Year 2.

[2] Assumes 2 equipped pickup trucks at $25,000 each and 1 bucket truck available from Utilities for limited usage at 50% of the $35,000 cost.

[3] OTDR test equipment at $10,000 and a fusion splicer at $40,000.

[4] Assumed to be 20% of total capital equipment, not including fiber infrastructure.

[5] Include 1 manager ($70,000/year) and 2 fiber technicians ($50,000/year starting in Year 2). Additional costs of $80,000 in Year 1 and $20,000 thereafter cover misc. cross-departmental costs.

[6] A 4% inflation rate was assumed to escalate Constant (1996) Dollar net cash flows to Current Dollar net cash flows.

[7] All assets purchased in Years 1-10 are assumed to be sold at the end of Year 10 for a multiple of operating cash flow (defined as the difference between revenue and all expenses before capital, interest, depreciation, and taxes) to account for the remaining value of newly developed assets. Although telecommunications network such as cable television historically sold at 7 to 12 times operating cash flow, a multiple of 4 was conservatively assumed to account for the fact that the network will not be a quasi-monopoly, will not have market dominance, and will face multiple well-financed, virtually unregulated competitors. Also, the assumed growth of the media businesses has strongly influenced their market values. The growth rate of this pure transport business will likely have far less appeal, especially by the year 2007. Finally, the fiber will be located in conduits shared with the Electric Utility and, as a result, would be assessed a lower value than fibers in a discrete network.

Table C11 (Page 1 of 2)
NOMINAL CASE FINANCIAL MODEL
Strategy 6 - Competitive Access Provider Network with Fiber Extensions for Cable Co-op's HFC Network

CAP Network Assumptions		
Network Capacity	2,400	Mbps
Max Number of T1s on Network [1]	1,600	
Peak Number of T1+ Customers [1]	100	
Yrs. of Growth to Peak No. of Customers	4	
Average Number of T1s per Customer [1]	5	
Pac Bell's Monthly T1 Rate	$ 430	
Discount off Pac Bell's Rate	25%	
Monthly T1 Rate	$ 323	
Anticipated Utilities Fiber Installation, years	7	
Asset Value, Multiple of Operating Cash Flow	4	

Co-op Fiber Lease Assumptions	
Number of Nodes	56
Fibers per Node	4
Avg. Primary Ring Miles / Node	3.75
Avg. Extension Miles / Node	0.75
Miles of Fiber Leased	1,008
Dark Fiber Lease Rate, $/fiber-mile-year	$ 1,500
Equivalent $/mo. per Home & Bus Passed	$ 4.50
Percent Leased in Year 2 (100% afterwards)	50%
Duration of Lease Payments, Years	10

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Annual Income (1996 Dollars)										
CAP Network										
Number of CAP Customers	0	25	50	75	100	100	100	100	100	100
Number of T1s Leased	0	125	250	375	500	500	500	500	500	500
T1 Lease Revenues	$ -	$ 483,750	$ 967,500	$ 1,451,250	$ 1,935,000	$ 1,935,000	$ 1,935,000	$ 1,935,000	$ 1,935,000	$ 1,935,000
Co-op Fiber Extension Revenues	$ -	$ 756,000	$ 1,512,000	$ 1,512,000	$ 1,512,000	$ 1,512,000	$ 1,512,000	$ 1,512,000	$ 1,512,000	$ 1,512,000
Total Revenues	$ -	$ 1,239,750	$ 2,479,500	$ 2,963,250	$ 3,447,000	$ 3,447,000	$ 3,447,000	$ 3,447,000	$ 3,447,000	$ 3,447,000
Annual Expenses (1996 Dollars)										
Construction Costs [2]										
Primary Fiber Rings	$ 675,678	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Secondary Fiber Rings	$ 365,180	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
SONET Hubs	$ 918,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
HFC Fiber Parallel to Primary Fiber Ring	$ 832,890	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fiber Extensions to HFC Nodes	$ 822,920	$ 411,460	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Other Network Costs										
CAP Network Control Center	$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Vehicles [3]	$ 92,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Equipment [4]	$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Plant Equipment Replacement Costs [5]	$ -	$ 222,100	$ 222,100	$ 222,100	$ 222,100	$ 222,100	$ 222,100	$ 222,100	$ 222,100	$ 222,100
Building Space Leased from City	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
Powering Costs	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
New Customer Hookup Costs										
Fiber Laterals	$ -	$ 207,163	$ 207,163	$ 207,163	$ 207,163	$ -	$ -	$ -	$ -	$ -
Additional SONET Eqpt. Packs [6]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Table C11 (Page 2 of 2)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Personnel Costs										
Salaries [7]	$ 210,000	$ 485,000	$ 460,000	$ 460,000	$ 460,000	$ 460,000	$ 460,000	$ 460,000	$ 460,000	$ 460,000
Benefits (33%)	$ 69,300	$ 160,050	$ 151,800	$ 151,800	$ 151,800	$ 151,800	$ 151,800	$ 151,800	$ 151,800	$ 151,800
Training / Technical Support (3%)	$ 6,300	$ 14,550	$ 13,800	$ 13,800	$ 13,800	$ 13,800	$ 13,800	$ 13,800	$ 13,800	$ 13,800
Total Costs	$ 4,107,768	$ 1,515,323	$ 1,069,863	$ 1,069,863	$ 1,069,863	$ 862,700	$ 862,700	$ 862,700	$ 862,700	$ 862,700
Cash Flow (1996 Dollars)	$ (4,107,768)	$ (275,573)	$ 1,409,637	$ 1,893,387	$ 2,377,137	$ 2,584,300	$ 2,584,300	$ 2,584,300	$ 2,584,300	$ 2,584,300
Cash Flow (Current Dollars) [8]	$ (4,107,768)	$ (286,596)	$ 1,524,664	$ 2,129,803	$ 2,780,914	$ 3,144,196	$ 3,269,964	$ 3,400,762	$ 3,536,793	$ 3,678,265
Electric Utility Financial Involvement (Current Dollars)										
Repayment of all Telecom Study Costs	$ (200,000)									
Avoided Utilities Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ 237,635	$ -	$ -	$ -
Startup Loan (from Utility Reserves)										
Balance at Start of Year	$ -	$ 4,566,234	$ 5,144,000	$ 3,927,976	$ 2,033,852	$ -	$ -	$ -	$ -	$ -
Loan Amount (Start of Year)	$ 4,307,768	$ 286,596	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest (6%)	$ 258,466	$ 291,170	$ 308,640	$ 235,679	$ 122,031	$ -	$ -	$ -	$ -	$ -
Loan Payments	$ -	$ -	$ (1,524,664)	$ (2,129,803)	$ (2,155,883)	$ -	$ -	$ -	$ -	$ -
Residual Value of Assets (Current Dollars)										
Sale of Assets [9]										$ 15,977,529
Retirement of Outstanding Debt										$ -
Net Cash Flow (Current Dollars)	$ -	$ -	$ -	$ -	$ 625,031	$ 3,144,196	$ 3,507,598	$ 3,400,762	$ 3,536,793	$ 19,655,794
NPV of Net Cash Flow (10 yr. @ 6%)	$ 21,432,291									

Notes

[1] Although the CAP network will be capable of supporting a variety signals (DS1, DS3, OC-1, OC-3, OC-12), T1 (i.e., DS-1) is used as a basic unit of measure. This is not intended to imply that only T1 services will be supported. The transported signals may include DS-1 = 1.544 Mbps, DS-3 = 44.736 Mbps, OC-1 = 51.84 Mbps, OC-3 = 155.52 Mbps, and/or OC-12 = 622.08 Mbps. It is anticipated that bandwidth demand per customer will increase over time, but that this will be offset by a decrease in the average size of customers that use CAP services.

[2] Construction buildout schedule: Fiber rings and SONET hubs -- 100% in Year 1; Fiber extensions to HFC nodes -- 2/3 in Year 1, 1/3 in Year 2.

[3] Assumes 3 equipped pickup trucks at $25,000 each and 1 bucket truck available from Utilities for limited usage at 50% of the $35,000 cost.

[4] OTDR test equipment at $10,000 and a fusion splicer at $40,000.

[5] Assumed to be 20% of total capital equipment, not including fiber infrastructure.

[6] Initial SONET hubs equipped at 50% capacity. If demand > 50% capacity, remaining hub capacity filled with SONET eqpt. packs.

[7] Year 1 cost covers management of network construction and contract negotiation. Costs thereafter cover marketing, contract management, and 7 staff (1 General Manager and 6 Fiber Technicians) at an average of $55,000 per year thereafter.

[8] A 4% inflation rate was assumed to escalate Constant (1996) Dollar net cash flows to Current Dollar net cash flows.

[9] All assets purchased in Years 1-10 are assumed to be sold at the end of Year 10 for a multiple of operating cash flow (defined as the difference between revenue and all expenses before capital, interest, depreciation, and taxes) to account for the remaining value of newly developed assets. Although telecommunications network such as cable television historically sold at 7 to 12 times operating cash flow, a multiple of 4 was conservatively assumed to account for the fact that the network will not be a quasi-monopoly, will not have market dominance, and will face multiple well-financed, virtually unregulated competitors. Also, the assumed growth of the media businesses has strongly influenced their market values. The growth rate of this pure transport business will likely have far less appeal, especially by the year 2007. Finally, the fiber will be located in conduits shared with the Electric Utility and, as a result, would be assessed a lower value than fibers in a discrete network.

Table C12 (Page 1 of 3)
NOMINAL CASE FINANCIAL MODEL
Strategy 7 - Dark Fiber Backbone and Hybrid Fiber-Coax Network

DFB Lease Assumptions	
Primary Ring Fibers Available for Lease	88
Length per Primary Ring Fiber, miles	15
Total Fiber-Miles Available for Lease	1,320
Dark Fiber Lease Rate, $/fiber-mile-year	$ 1,500
Peak Leased Fiber-Miles, Percent of Total	50%
Yrs. of Growth to Peak Leased Fiber-Miles	3
Anticipated Utilities Fiber Installation, years	7
Asset Value, Multiple of Operating Cash Flow	4

HFC Network Assumptions	
Max Potential HFC Drops	28,000
Initial Drops, Percent of Max Potential	25%
Peak Drops, Percent Max Potential	75%
Years to Reach Peak Drops	5
Average Cost per Coax Drop Installation	$ 87
External Financing - Loan Period, Years	10
External Financing - Interest Rate	8%
Number of 6 MHz Channels Available for Lease	95
Average Channel Lease Rate (per 6 MHz channel), $/channel-year	$ 55,000
Equivalent Lease Rate, $ / Home & Bus. Passed per Month	$ 0.16
Initial Channels Leased, % of Available	40%
Peak Channels Leased, % of Available	90%
Time to Peak Channels Leased, Years	5

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Annual Income (1996 Dollars)										
Dark Fiber Backbone										
Percent of DFB Fibers Leased	0%	17%	33%	50%	50%	50%	50%	50%	50%	50%
Total DFB Lease Revenues	$ -	$ 330,000	$ 660,000	$ 990,000	$ 990,000	$ 990,000	$ 990,000	$ 990,000	$ 990,000	$ 990,000
HFC Network										
Percent of Buildings with Drops	0%	0%	25%	35%	45%	55%	65%	75%	75%	75%
Number of HFC Channels Leased	0	0	38	48	57	67	76	86	86	86
Total HFC Network Revenues	$ -	$ -	$ 2,090,000	$ 2,640,000	$ 3,135,000	$ 3,685,000	$ 4,180,000	$ 4,730,000	$ 4,730,000	$ 4,730,000
Total Revenues	$ -	$ 330,000	$ 2,750,000	$ 3,630,000	$ 4,125,000	$ 4,675,000	$ 5,170,000	$ 5,720,000	$ 5,720,000	$ 5,720,000
Annual Expenses (1996 Dollars)										
Construction Costs [1]										
Primary Fiber Ring	$ 675,678	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
HFC Fiber Parallel to Primary Fiber RIng	$ 832,890	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fiber Extensions to HFC Nodes	$ 822,920	$ 411,460	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
HFC Nodes	$ 421,867	$ 843,733	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Coaxial Cabling	$ -	$ 6,395,130	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Coax Plant Equipment	$ -	$ 882,656	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Other Network Costs										
Minimal HFC Headend Equipment	$ -	$ 928,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Vehicles [2]	$ 235,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Equipment [3]	$ 88,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Plant Equipment Replacement Costs [4]	$ -	$ 149,073	$ 680,051	$ 680,051	$ 680,051	$ 680,051	$ 680,051	$ 680,051	$ 680,051	$ 680,051
Building Space Leased from City	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000
Powering Costs	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000

Table C12 (Page 2 of 3)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
New Customer Hookup Costs										
Coax Drops	$ -	$ -	$ 606,900	$ 242,760	$ 242,760	$ 242,760	$ 242,760	$ 242,760	$ 0	$ -
Personnel Costs										
Salaries [5]	$ 305,000	$ 345,000	$ 1,310,000	$ 1,310,000	$ 1,310,000	$ 1,310,000	$ 1,310,000	$ 1,310,000	$ 1,310,000	$ 1,310,000
Benefits (33%)	$ 100,650	$ 113,850	$ 432,300	$ 432,300	$ 432,300	$ 432,300	$ 432,300	$ 432,300	$ 432,300	$ 432,300
Training / Technical Support (3%)	$ 9,150	$ 10,350	$ 39,300	$ 39,300	$ 39,300	$ 39,300	$ 39,300	$ 39,300	$ 39,300	$ 39,300
Total Costs	$ 3,596,655	$ 10,184,753	$ 3,173,551	$ 2,809,411	$ 2,809,411	$ 2,809,411	$ 2,809,411	$ 2,809,411	$ 2,566,651	$ 2,566,651
Cash Flow (1996 Dollars)	$ (3,596,655)	$ (9,854,753)	$ (423,551)	$ 820,589	$ 1,315,589	$ 1,865,589	$ 2,360,589	$ 2,910,589	$ 3,153,349	$ 3,153,349
Cash Flow (Current Dollars) [6]	$ (3,596,655)	$ (10,248,943)	$ (458,113)	$ 923,051	$ 1,539,053	$ 2,269,774	$ 2,986,898	$ 3,830,136	$ 4,315,576	$ 4,488,199
Revenue Bond Financing (Current Dollars)										
Startup Loan (External Financing)										
Balance at Start of Year			$ 18,360,000	$ 17,092,619	$ 15,723,847	$ 14,245,573	$ 12,649,037	$ 10,924,779	$ 9,062,580	$ 7,051,405
Bond Issuance Amount		$ 17,000,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest (Rate specified above)		$ 1,360,000	$ 1,468,800	$ 1,367,409	$ 1,257,908	$ 1,139,646	$ 1,011,923	$ 873,982	$ 725,006	$ 564,112
Payments		$ -	$ (2,736,181)	$ (2,736,181)	$ (2,736,181)	$ (2,736,181)	$ (2,736,181)	$ (2,736,181)	$ (2,736,181)	$ (2,736,181)
Estimated Bond Counsel Fees (6%)		$ (1,020,000)								
Electric Utility Financial Involvement (Current Dollars)										
Repayment of all Telecom Study Costs	$ (200,000)									
Avoided Utilities Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ 237,635	$ -	$ -	$ -
Startup Loan (from Utility Reserves)										
Balance at Start of Year	$ -	$ 4,024,454	$ -	$ 1,739,726	$ 3,766,028	$ 5,260,946	$ 6,070,994	$ 5,946,903	$ 5,209,762	$ 3,942,954
Loan Amount (Start of Year)	$ 3,796,655	$ -	$ 1,641,251	$ 1,813,131	$ 1,197,129	$ 466,407	$ -	$ -	$ -	$ -
Interest (6%)	$ 227,799	$ 241,467	$ 98,475	$ 213,171	$ 297,789	$ 343,641	$ 364,260	$ 356,814	$ 312,586	$ 236,577
Loan Payments	$ -	$ (4,265,921)	$ -	$ -	$ -	$ -	$ (488,351)	$ (1,093,955)	$ (1,579,394)	$ (1,752,017)
Cash Flow Management Fund (Current Dollars)										
Balance at Start of Year		$ -	$ 1,553,044							
Amount Deposited		$ 1,465,136	$ -							
Interest Earnings on Fund (6%)		$ 87,908	$ -							
Amount Withdrawn		$ -	$ 1,553,044							
Residual Value of Assets (Current Dollars)										
Sale of Assets [7]										$ 21,824,494
Retirement of Outstanding Debt										$ (7,306,850)
Net Cash Flow (Current Dollars)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 14,517,644
NPV of Net Cash Flow (10 yr. @ 6%)	$ 8,592,971									

Notes

[1] Construction buildout schedule: Fiber rings -- 100% in Year 1; Fiber extensions to HFC nodes -- 2/3 in Year 1, 1/3 in Year 2.

[2] Assumes 8 equipped pickups trucks (2 for DFB technicians and 6 for HFC service technicians) at $25,000 each and one equipped bucket truck for the HFC line technician at $35,000.

[3] Includes OTDR test eqpt. at $10k, a fusion splicer at $40k, a $25k spectrum analyzer for the Headend Tech., signal level meters at $1500 per Svc. Tech., and tools at $750 per Svc. Tech.

[4] Assumed to be 20% of total capital equipment, not including fiber infrastructure.

[5] Assumes phase-in of 27 staff (FTEs) at an avg. of $45,000 per year. (1 General Mgr., 1 Office Mgr.; DFB Network -- 2 Fiber Techs.; HFC Network -- 1 Chief Engineer, 1 Headend Technician, 0 Line Technician, 6 Installers, 6 Service Techs., 3 Dispatchers, and 5 Customer Svc. Reps (4 FT, 2 PT)). Additional costs are also assumed for miscellaneous cross-departmental charges.

[6] A 4% inflation rate was assumed to escalate Constant (1996) Dollar net cash flows to Current Dollar net cash flows.

[7] All assets purchased in Years 1-10 are assumed to be sold at the end of Year 10 for a multiple of operating cash flow (defined as the difference between revenue and all expenses before capital, interest, depreciation, and taxes) to account for the remaining value of newly developed assets. Although telecommunications network such as cable television historically sold at 7 to 12 times operating cash flow, a multiple of 4 was conservatively assumed to account for the fact that the network will not be a quasi-monopoly, will not have market dominance, and will face multiple well-financed, virtually unregulated competitors. Also, the assumed growth of the media businesses has strongly influenced their market values. The growth rate of this pure transport business will likely have far less appeal, especially by the year 2007. Also, the fiber will be located in conduits shared with the Electric Utility and, as a result, would be assessed a lower value than fibers in a discrete network. Finally, the City would not own the HFC operating business, its customers, and their goodwill. As a result, the market value of the underlying asset is far less than it would be if the City owned the distribution network and provided services directly.

Table C13 (Page 1 of 3)
NOMINAL CASE FINANCIAL MODEL
Strategy 8 - Competitive Access Provider and Hybrid Fiber-Coax Networks

CAP Network Assumptions		HFC Network Assumptions	
Network Capacity	2,400 Mbps	Max Potential HFC Drops	28,000
Max Number of T1s on Network [1]	1,600	Initial Drops, Percent of Max Potential	25%
Peak Number of T1+ Customers [1]	100	Peak Drops, Percent Max Potential	75%
Yrs. of Growth to Peak No. of Customers	4	Years to Reach Peak Drops	5
Average Number of T1s per Customers [1]	5	Average Cost per Coax Drop Installation	$ 87
Pac Bell's Current Avg. Monthly T1 Rate	$ 430	External Financing - Loan Period, Years	10
Pac Bell's Near Future T1 Rate Reduction	20%	External Financing - Interest Rate	8%
City's Discount off Pac Bell's Current Rate	25%	Number of 6 MHz Channels Available for Lease	95
City's Average Monthly T1 Rate	$ 323	Average Channel Lease Rate (per 6 MHz channel), $/channel-year	$ 55,000
Anticipated Utilities Fiber Installation, years	7	Equivalent Lease Rate, $ / Home & Bus. Passed per Month	$ 0.16
Asset Value, Multiple of Operating Cash Flow	4	Initial Channels Leased, % of Available	40%
		Peak Channels Leased, % of Available	90%
		Time to Peak Channels Leased, Years	5

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Annual Income (1996 Dollars)										
CAP Network										
Number of CAP Customers	0	25	50	75	100	100	100	100	100	100
Number of T1s Leased	0	125	250	375	500	500	500	500	500	500
Total CAP Network Revenues	$ -	$ 483,750	$ 967,500	$ 1,451,250	$ 1,935,000	$ 1,935,000	$ 1,935,000	$ 1,935,000	$ 1,935,000	$ 1,935,000
HFC Network										
Percent of Buildings with Drops	0%	0%	25%	35%	45%	55%	65%	75%	75%	75%
Number of HFC Channels Leased	0	0	38	48	57	67	76	86	86	86
Total HFC Network Revenues	$ -	$ -	$ 2,090,000	$ 2,640,000	$ 3,135,000	$ 3,685,000	$ 4,180,000	$ 4,730,000	$ 4,730,000	$ 4,730,000
Total Revenues	$ -	$ 483,750	$ 3,057,500	$ 4,091,250	$ 5,070,000	$ 5,620,000	$ 6,115,000	$ 6,665,000	$ 6,665,000	$ 6,665,000
Annual Expenses (1996 Dollars)										
Construction Costs [2]										
Primary Fiber Ring	$ 675,678	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Secondary Fiber Rings	$ 365,180	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
SONET Hubs	$ 918,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
HFC Fiber Parallel to Primary Fiber RIng	$ 832,890	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fiber Extensions to HFC Nodes	$ 822,920	$ 411,460	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
HFC Nodes	$ 421,867	$ 843,733	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Coaxial Cabling	$ -	$ 6,395,130	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Coax Plant Equipment	$ -	$ 882,656	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Table C13 (Page 2 of 3)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Other Network Costs										
CAP Network Control Center	$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Minimal HFC Headend Equipment	$ -	$ 928,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Vehicles [3]	$ 260,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Equipment [4]	$ 88,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Plant Equipment Replacement Costs [5]	$ -	$ 347,673	$ 878,651	$ 878,651	$ 878,651	$ 878,651	$ 878,651	$ 878,651	$ 878,651	$ 878,651
Building Space Leased from City	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000
Powering Costs	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000
New Customer Hookup Costs										
Fiber Laterals	$ -	$ 207,163	$ 207,163	$ 207,163	$ 207,163	$ -	$ -	$ -	$ -	$ -
Additional SONET Eqpt. Packs [6]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Coax Drops	$ -	$ -	$ 606,900	$ 242,760	$ 242,760	$ 242,760	$ 242,760	$ 242,760	$ 0	$ -
Personnel Costs										
Salaries [7]	$ 305,000	$ 565,000	$ 1,520,000	$ 1,520,000	$ 1,520,000	$ 1,520,000	$ 1,520,000	$ 1,520,000	$ 1,520,000	$ 1,520,000
Benefits (33%)	$ 100,650	$ 186,450	$ 501,600	$ 501,600	$ 501,600	$ 501,600	$ 501,600	$ 501,600	$ 501,600	$ 501,600
Training / Technical Support (3%)	$ 9,150	$ 16,950	$ 45,600	$ 45,600	$ 45,600	$ 45,600	$ 45,600	$ 45,600	$ 45,600	$ 45,600
Total Costs	$ 4,959,835	$ 10,894,716	$ 3,869,914	$ 3,505,774	$ 3,505,774	$ 3,298,611	$ 3,298,611	$ 3,298,611	$ 3,055,851	$ 3,055,851
Cash Flow (1996 Dollars)	$ (4,959,835)	$(10,410,966)	$ (812,414)	$ 585,476	$ 1,564,226	$ 2,321,389	$ 2,816,389	$ 3,366,389	$ 3,609,149	$ 3,609,149
Cash Flow (Current Dollars) [8]	$ (4,959,835)	$(10,827,404)	$ (878,707)	$ 658,581	$ 1,829,923	$ 2,824,324	$ 3,563,630	$ 4,429,938	$ 4,939,369	$ 5,136,944
Revenue Bond Financing (Current Dollars)										
Startup Loan (External Financing)										
Balance at Start of Year			$ 21,600,000	$ 20,108,963	$ 18,498,643	$ 16,759,498	$ 14,881,220	$ 12,852,681	$ 10,661,859	$ 8,295,770
Bond Issuance Amount		$ 20,000,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest (Rate specified above)		$ 1,600,000	$ 1,728,000	$ 1,608,717	$ 1,479,891	$ 1,340,760	$ 1,190,498	$ 1,028,214	$ 852,949	$ 663,662
Payments		$ -	$ (3,219,037)	$ (3,219,037)	$ (3,219,037)	$ (3,219,037)	$ (3,219,037)	$ (3,219,037)	$ (3,219,037)	$ (3,219,037)
Estimated Bond Counsel Fees (6%)		$ (1,200,000)								
Electric Utility Financial Involvement (Current Dollars)										
Repayment of all Telecom Study Costs	$ (200,000)									
Avoided Utilities Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ 237,635	$ -	$ -	$ -
Startup Loan (from Utility Reserves)										
Balance at Start of Year	$ -	$ 5,469,425	$ -	$ 1,899,773	$ 4,727,843	$ 6,483,974	$ 7,291,408	$ 7,146,664	$ 6,364,563	$ 5,026,105
Loan Amount (Start of Year)	$ 5,159,835	$ -	$ 1,792,238	$ 2,560,456	$ 1,389,114	$ 394,713	$ -	$ -	$ -	$ -
Interest (6%)	$ 309,590	$ 328,165	$ 107,534	$ 267,614	$ 367,017	$ 412,721	$ 437,484	$ 428,800	$ 381,874	$ 301,566
Loan Payments	$ -	$ (5,797,590)	$ -	$ -	$ -	$ -	$ (582,228)	$ (1,210,901)	$ (1,720,332)	$ (1,917,907)

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	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Cash Flow Management Fund (Current Dollars)										
Balance at Start of Year		$ -	$ 2,305,506							
Amount Deposited		$ 2,175,005	$ -							
Interest Earnings on Fund (6%)		$ 130,500	$ -							
Amount Withdrawn		$ -	$ 2,305,506							
Residual Value of Assets (Current Dollars)										
Sale of Assets [7]										$ 25,550,155
Retirement of Outstanding Debt										$ (9,150,159)
Net Cash Flow (Current Dollars)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,399,996

NPV of Net Cash Flow (10 yr. @ 6%) $ 9,707,132

Notes

[1] Although the CAP network will be capable of supporting a variety signals (DS1, DS3, OC-1, OC-3, OC-12), T1 (i.e., DS-1) is used as a basic unit of measure. This is not intended to imply that only T1 services will be supported. The transported signals may include DS-1 = 1.544 Mbps, DS-3 = 44.736 Mbps, OC-1 = 51.84 Mbps, OC-3 = 155.52 Mbps, and/or OC-12 = 622.08 Mbps. It is anticipated that bandwidth demand per customer will increase over time, but that this will be offset by a decrease in the average size of customers that use CAP services.

[2] Construction buildout schedule: Fiber rings & SONET hubs - 100% in yr. 1; Fiber ext. to HFC nodes - 2/3 in yr. 1, 1/3 in yr. 2; HFC nodes - 1/3 in yr. 1, 2/3 in yr. 2; Coax plant - 100% in yr. 2.

[3] Assumes 9 equipped pickups trucks (3 for CAP technicians and 6 for HFC service technicians) at $25,000 each and one equipped bucket truck for the HFC line technician at $35,000.

[4] Includes OTDR test eqpt. at $10k, a fusion splicer at $40k, a $25k spectrum analyzer for the Headend Tech., signal level meters at $1500 per Svc. Tech., and tools at $750 per Svc. Tech.

[5] Assumed to be 20% of total capital equipment, not including fiber infrastructure.

[6] Initial SONET hubs equipped at 50% capacity. If demand > 50% capacity, remaining hub capacity filled with SONET eqpt. packs.

[7] Assumes phase-in of 31 staff (FTEs) at an avg. of $45,000 per year. (1 General Mgr., 1 Office Mgr.; CAP Network -- 6 Fiber Techs.; HFC Network -- 1 Chief Engineer, 1 Headend Technician, 0 Line Technician, 6 Installers, 6 Service Techs., 3 Dispatchers, and 5 Customer Svc. Reps (4 FT, 2 PT)). Additional costs are also assumed for miscellaneous cross-departmental charges.

[8] A 4% inflation rate was assumed to escalate Constant (1996) Dollar net cash flows to Current Dollar net cash flows.

[9] All assets purchased in Years 1-10 are assumed to be sold at the end of Year 10 for a multiple of operating cash flow (defined as the difference between revenue and all expenses before capital, interest, depreciation, and taxes) to account for the remaining value of newly developed assets. Although telecommunications network such as cable television historically sold at 7 to 12 times operating cash flow, a multiple of 4 was conservatively assumed to account for the fact that the network will not be a quasi-monopoly, will not have market dominance, and will face multiple well-financed, virtually unregulated competitors. Also, the assumed growth of the media businesses has strongly influenced their market values. The growth rate of this pure transport business will likely have far less appeal, especially by the year 2007. Also, the fiber will be located in conduits shared with the Electric Utility and, as a result, would be assessed a lower value than fibers in a discrete network. Finally, the City would not own the HFC operating business, its customers, and their goodwill. As a result, the market value of the underlying asset is far less than it would be if the City owned the distribution network and provided services directly.

Table C14
Avoided Construction Cost Estimate for a Utilities Dark Fiber Backbone

Network Cost Element	CAP Network Cost Elements				HFC Network Cost Elements				Totals
	Primary Fiber Ring	Secondary Fiber Rings	Fiber Laterals for CAP Services	SONET Hubs	Fiber Extensions to HFC Nodes	HFC Nodes	Coax Plant	Coax Drops	
Miles of Plant	15.0								15.0
Percent of Plant Overhead	30%								
% of Underground Plant in Existing Conduit	100%								
Miles of Overhead Plant	4.5								4.5
Miles of Underground Plant in Existing Condui	10.5								10.5
Miles of Underground Plant in New Conduit	0.0								0.0
Fiber Strands per Cable	8								
Cabling Costs									
Fiber Cost	$ 44,352	$ -	$ -		$ -		$ -	$ -	$ 44,352
Fiber Sheath Cost	$ 19,800	$ -	$ -		$ -		$ -	$ -	$ 19,800
Coaxial Cable Cost	$ -	$ -	$ -		$ -		$ -	$ -	$ -
Overhead Labor Cost	$ 47,520	$ -	$ -		$ -		$ -	$ -	$ 47,520
Pole Make-Ready Cost	$ 5,940	$ -	$ -		$ -		$ -	$ -	$ 5,940
Underground Pull Cost	$ 55,440	$ -	$ -		$ -		$ -	$ -	$ 55,440
New Underground Labor Cost	$ -	$ -	$ -		$ -		$ -	$ -	$ -
New Conduit Cost	$ -	$ -	$ -		$ -		$ -	$ -	$ -
Total Estimated Cabling Cost	$ 173,052	$ -	$ -		$ -		$ -	$ -	$ 173,052
Equipment Costs									
OC-48 SONET Hubs (3)									$ -
OC-12 SONET Hubs (6)									$ -
HFC Nodes (51)									$ -
Coax Amplifiers, Taps, and Connectors									$ -
Fixed Network Costs									
Design Services	$ 9,504	$ -	$ -		$ -		$ -		$ 9,504
Traffic Control & Other	$ 5,250	$ -	$ -		$ -		$ -		$ 5,250
Other Miscellaneous Costs									
Damage Claims									$ -
Insurance Premiums									$ -
Bond Premiums									$ -
Publications									$ -
Estimated Total Cost (1996 Dollars)	$ 187,806	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 187,806

Table C15
ESTIMATED HEADEND EQUIPMENT COSTS

Fixed Costs		
Building / Site Acquisition	$	-
Building Improvements	$	25,000
Furniture & Fixtures	$	10,000
Back-up Power Supply	$	25,000
Site Improvements	$	10,000
Spectrum Management Unit	$	25,000
Misc. Fiber Costs	$	28,000
Other	$	-
Subtotal	$	123,000
Video Equipment		
Analog Eqpt.		
Modulators / Processors	$	280,000
ECM Equipment	$	1,000
Digital Eqpt.		
Multiplexers	$	36,000
Modulators	$	200,000
Control Computers	$	25,000
Subtotal	$	542,000
Telephone Equipment		
RF Modulators (1 per Node)	$	56,000
RF Demodulator (1 per Node)	$	56,000
Control Computers	$	25,000
Subtotal	$	137,000
Network Monitoring Equipment		
Power Management Eqpt.	$	15,000
Status Monitoring Eqpt.	$	20,000
Test Equipment	$	75,000
Other	$	-
Subtotal	$	110,000
Miscellaneous		
Security Equipment	$	5,000
Fire & Temperature Alarms	$	1,500
Fure Suppression Equipment	$	10,000
Other	$	-
Subtotal	$	16,500
TOTAL HEADEND EQPT. COST	$	928,500

C.5. Deterministic Sensitivity Analysis

Uncertain variables were identified and tested for their impact on the NPV of net cash flow. For every uncertain variable, "low", "nominal", and "high" values were specified. These variables are intended to represent "10-50-90" points on a cumulative probability distribution. For the "low" value, this implies that there is a 10% chance that the actual value will be less than the "low" value (and a 90% chance that the actual value will be greater than the "low" value). Similarly, there is a 50% chance that the actual value will be less than the "nominal" value (i.e., a 50% chance that the actual value will greater than the "nominal" value) and a 90% chance that the actual value will be less than the "high" value (i.e., a 10% chance that the actual value will be greater than the "high" value.)

After assessing the low, nominal, and high values for each uncertain variable, the nominal case values for each strategy were recorded. (These are the same values as were presented above in Tables C6 - C13.) The impact of the uncertainty for each variable was then determined by calculating the NPV of net cash flow when the uncertain variables are changed, one variable at a time, from their low to high values while holding all other variables fixed at their nominal values. The detailed results of this deterministic sensitive analysis are presented in Table C16.

For each strategy, the variables were sorted based upon the magnitude of their NPV swing (i.e., the difference between their low and high NPV values) and "tornado diagrams" were plotted as shown in Figures C1 - C8. (These diagrams are called tornado diagrams because their shape resembles that of a tornado.) The width of a given bar measures the impact of uncertainty for a given variable on the NPV of net cash flow. The variables with the widest bars are those to which the NPV of net cash flow is most sensitive. The dark-shaded areas on a few of the bars highlight negative the portions of those bars that have a negative NPV of net cash flow. The vertical lines in the middle of all of the bars represent the NPV of net cash flow when all variables are set to their nominal values.

The important conclusion to be drawn from Figures C1 - C8 is that the uncertainty in some variables is much more significant than that in other variables. For this reason, the probabilistic analysis is focused on the uncertainty in those few variables whose uncertainty has the most significant impact.

Variables meeting either of the following two criteria were classified as significant uncertain variables for the probabilistic analysis:

1.) The two variables with the biggest impact on the NPV of net cash flow for each strategy.

2.) Any variable resulting in a spread in the low-to-high NPV value greater than $8 million for any strategy.

Table C16 (Page 1 of 2)
Detailed Results of the Deterministic Sensitivity Analysis

Uncertain Variable	Input Values			Resulting 10-year NPV of Net Cash Flows			Low-to-High
	Nominal	Low	High	Nominal Input	Low Input	High Input	NPV Swing
1 - Lease Existing Infrastructure with Minimal Requirements				**$4,079,627**			
Revenues							
Miles of Leased Right of Way (MinReq)	20	15	30		$2,972,497	$6,291,019	$ 3,318,522
Percent Overhead (MinReq)	20%	10%	30%		$4,628,586	$3,530,667	$ 1,097,919
Overhead Rate (MinReq), $ / Pole-Year	$ 6.00	$ 4.00	$ 10.00		$4,077,171	$4,084,539	$ 7,369
Conduit Lease Rate (MinReq), $ / Foot-Year	$ 6.00	$ 3.00	$ 9.00		$1,869,051	$6,287,348	$ 4,418,296
Costs							
Personnel Costs (LeaseOpts)	100%	80%	120%		$4,140,510	$4,018,744	$ 121,766
2 - Lease Existing Infrastructure with Residential Requirements				**$4,894,848**			
Revenues							
Miles of Leased Right of Way (ResReq)	150	120	180		$3,702,731	$6,086,961	$ 2,384,230
Percent Overhead (ResReq)	70%	65%	80%		$5,859,438	$2,965,661	$ 2,893,777
Overhead Rate (ResReq), $ / Pole-Year	$ 4.00	$ 3.00	$ 10.00		$4,864,567	$5,076,518	$ 211,951
Conduit Lease Rate (ResReq), $ / Foot-Year	$ 3.00	$ 1.50	$ 5.00		$1,975,116	$8,787,819	$ 6,812,703
Costs							
Personnel Costs (LeaseOpts)	100%	80%	120%		$5,099,096	$4,690,596	$ 408,501
3 - Dark Fiber Backbone				**$7,050,042**			
Revenues							
Dark Fiber Lease Rate, $/fiber-mile-year	$ 1,500	$ 1,200	$ 2,400		$4,953,787	$13,338,807	$ 8,385,020
Peak Primary Ring Fiber Lease, % of Available	50%	20%	100%		$756,720	$17,531,317	$ 16,774,597
Years to Reach Primary Ring Fiber Lease Peak	3	1	5		$8,015,253	$8,108,250	$ 1,907,003
Time to Utilities Fiber Ring Installation, Years	7	5	10		$7,056,547	$7,040,737	$ 15,810
Asset Value, Multiple of Operating Cash Flow	4	2	6		$5,709,526	$8,390,558	$ 2,681,032
Costs							
Primary Ring Cost, % of Nominal	100%	95%	120%		$7,085,853	$6,906,798	$ 179,055
Annual Equipment Replacement Costs, % of Capital Eqpt.	20%	15%	30%		$7,080,763	$6,988,600	$ 92,163
DFB Personnel Costs, % of Nominal	100%	80%	120%		$7,533,575	$6,566,509	$ 967,066
4 - Competitive Access Provider Network				**$7,122,153**			
Revenues							
Peak Number of CAP (T1+) Customers	100	50	150		($2,305,741)	$16,520,346	$ 18,826,088
Time to Reach Peak Number of CAP Customers, Years	4	3	8		$8,050,538	$3,520,684	$ 4,529,854
Average Number of T1s per CAP Customer	5	3	7		($746,119)	$14,962,684	$ 15,708,803
City's Average Monthly T1 Rate	100%	85%	110%		$4,175,410	$9,085,962	$ 4,910,552
Time to Utilities Fiber Ring Installation, Years	7	5	10		$7,128,658	$7,112,849	$ 15,810
Asset Value, Multiple of Operating Cash Flow	4	2	6		$4,917,614	$9,326,692	$ 4,409,078
Costs							
Primary Ring Cost, % of Nominal	100%	95%	120%		$7,157,964	$6,978,910	$ 179,055
Secondary Ring Cost, % of Nominal	100%	95%	140%		$7,141,508	$6,967,317	$ 174,191
SONET Hub Costs, % of Nominal	100%	80%	120%		$7,621,872	$6,622,434	$ 999,438
Annual Equipment Replacement Costs, % of Capital Eqpt.	20%	15%	30%		$7,576,235	$6,213,990	$ 1,362,246
Cost per CAP Customer Fiber Lateral	100%	80%	120%		$7,285,044	$6,959,262	$ 325,782
Number of CAP Staff	7	5	8		$8,865,553	$6,248,584	$ 2,616,969
5 - Dark Fiber Backbone & Dark Fiber Extensions for Cable Co-op				**$20,470,657**			
Revenues							
Dark Fiber Lease Rate, $/fiber-mile-year	$ 1,500	$ 1,200	$ 2,400		$15,026,368	$36,803,526	$ 21,777,158
Peak Primary Ring Fiber Lease, % of Available	50%	20%	100%		$14,181,892	$30,951,933	$ 16,770,041
Years to Reach Primary Ring Fiber Lease Peak	3	1	5		$21,435,869	$19,529,537	$ 1,906,332
Duration of Co-op (or Successor) Lease Payments, Years	10	1	20		$4,472,221	$20,470,657	$ 15,998,436
Time to Utilities Fiber Ring Installation, Years	7	5	10		$20,477,162	$20,461,353	$ 15,810
Asset Value, Multiple of Operating Cash Flow	4	2	6		$16,718,695	$24,222,620	$ 7,503,925
Costs							
Primary Ring Cost, % of Nominal	100%	95%	120%		$20,550,611	$20,150,841	$ 399,771
Cost of Fiber Extensions to HFC Node Sites, % of Nominal	100%	95%	140%		$20,534,457	$19,960,261	$ 574,196
Annual Equipment Replacement Costs, % of Capital Eqpt.	20%	15%	30%		$20,518,787	$20,374,398	$ 144,389
DFB Personnel Costs, % of Nominal	100%	80%	120%		$21,148,247	$19,793,067	$ 1,355,180

Table C16 (Page 2 of 2)

Uncertain Variable	Input Values			Resulting 10-year NPV of Net Cash Flows			Low-to-High
	Nominal	Low	High	Nominal Input	Low Input	High Input	NPV Swing
6 - Competitive Access Provider Network & Dark Fiber Extensions for Cable Co-op				**$21,432,291**			
Revenues							
Peak Number of CAP (T1+) Customers	100	50	150		$12,039,000	$30,825,583	$ 18,786,583
Time to Reach Peak Number of CAP Customers, Years	4	3	8		$22,355,774	$17,865,425	$ 4,490,349
Average Number of T1s per CAP Customer	5	3	7		$13,596,662	$29,267,920	$ 15,671,258
City's Average Monthly T1 Rate	100%	85%	110%		$18,493,930	$23,391,199	$ 4,897,268
Dark Fiber Lease Rate, $/fiber-mile-year	$ 1,500	$ 1,200	$ 2,400		$18,075,356	$31,492,617	$ 13,417,261
Duration of Co-op (or Successor) Lease Payments, Years	10	1	20		$5,427,943	$21,432,291	$ 16,004,348
Time to Utilities Fiber Ring Installation, Years	7	5	10		$21,438,796	$21,422,987	$ 15,810
Asset Value, Multiple of Operating Cash Flow	4	2	6		$16,703,754	$26,160,829	$ 9,457,075
Costs							
Primary Ring Cost, % of Nominal	100%	95%	120%		$21,512,245	$21,112,475	$ 399,771
Secondary Ring Cost, % of Nominal	100%	95%	140%		$21,451,646	$21,277,455	$ 174,191
SONET Hub Costs, % of Nominal	100%	80%	120%		$21,929,890	$20,934,693	$ 995,197
Cost of Fiber Extensions to HFC Node Sites, % of Nominal	100%	95%	140%		$21,497,302	$20,912,206	$ 585,096
Annual Equipment Replacement Costs, % of Capital Eqpt.	20%	15%	30%		$21,890,436	$20,516,001	$ 1,374,436
Cost per CAP Customer Fiber Lateral	100%	80%	120%		$21,592,789	$21,271,793	$ 320,996
Number of CAP Staff	7	5	8		$23,170,789	$20,563,042	$ 2,607,747
7 - Dark Fiber Backbone & Hybrid Fiber-Coax Network				**$8,592,971**			
Revenues							
Dark Fiber Lease Rate, $/fiber-mile-year	$ 1,500	$ 1,200	$ 2,400		$6,452,178	$15,003,862	$ 8,551,684
Peak Primary Ring Fiber Lease, % of Available	50%	20%	100%		$2,159,455	$19,263,848	$ 17,104,392
Years to Reach Primary Ring Fiber Lease Peak	3	1	5		$9,616,096	$7,595,383	$ 2,020,712
Average Channel Lease Rate, $/channel-year	$ 55,000	$ 25,000	$ 60,000		($15,338,111)	$12,525,677	$ 27,863,788
Initial Channels Leased, % of Available	40%	20%	60%		$5,431,165	$11,646,622	$ 6,215,457
Peak Channels Leased, % of Available	90%	50%	100%		($8,001,505)	$12,464,946	$ 20,466,452
Time to Peak Channels Leased, Years	5	3	7		$11,087,218	$6,124,790	$ 4,962,428
Time to Utilities Fiber Ring Installation, Years	7	5	10		$8,609,918	$8,583,667	$ 26,251
Asset Value, Multiple of Operating Cash Flow	4	2	6		$2,134,029	$15,051,913	$ 12,917,884
Costs							
Primary Ring Cost, % of Nominal	100%	95%	120%		$8,677,723	$8,253,966	$ 423,757
Cost of Fiber Extensions to HFC Node Sites, % of Nominal	100%	95%	140%		$8,660,599	$8,051,951	$ 608,648
Annual Equipment Replacement Costs, % of Capital Eqpt.	20%	15%	30%		$9,895,899	$5,987,116	$ 3,908,782
HFC Node Costs, % of Nominal	100%	90%	130%		$8,925,108	$7,596,560	$ 1,328,548
Coaxial Cabling Cost, % of Nominal	100%	80%	130%		$9,923,158	$6,627,699	$ 3,295,459
Coaxial Plant Equipment, % of Nominal	100%	90%	110%		$8,816,031	$8,369,911	$ 446,120
Minimal HFC Headend Equipment, % of Nominal	100%	90%	130%		$8,827,617	$7,889,035	$ 938,582
Average Cost per Coax Drop Installation	$ 87	$ 75	$ 150		$8,830,978	$7,305,291	$ 1,525,687
DFB Personnel Costs, % of Nominal	100%	80%	120%		$9,089,893	$8,096,050	$ 993,843
Number of HFC Staff	24	20	28		$11,238,169	$5,947,773	$ 5,290,397
Loan Period, Years	10	7	15		$8,770,947	$8,444,681	$ 326,266
Loan Interest Rate (Current Dollars)	8%	6%	10%		$10,566,860	$6,495,072	$ 4,071,788
8 - Competitive Access Provider Network & Hybrid Fiber-Coax Network				**$9,707,132**			
Revenues							
Peak Number of CAP (T1+) Customers	100	50	150		$126,187	$19,223,360	$ 19,097,174
Time to Reach Peak Number of CAP Customers, Years	4	3	8		$10,680,271	$5,982,987	$ 4,697,284
Average Number of T1s per CAP Customer	5	3	7		$1,714,204	$17,658,739	$ 15,944,535
City's Average Monthly T1 Rate	100%	85%	110%		$6,716,083	$11,701,165	$ 4,985,082
Average Channel Lease Rate, $/channel-year	$ 55,000	$ 25,000	$ 60,000		($14,204,115)	$13,639,261	$ 27,843,376
Initial Channels Leased, % of Available	40%	20%	60%		$6,545,326	$12,757,569	$ 6,212,243
Peak Channels Leased, % of Available	90%	50%	100%		($6,867,510)	$13,579,108	$ 20,446,617
Time to Peak Channels Leased, Years	5	3	7		$12,198,165	$7,242,922	$ 4,955,243
Time to Utilities Fiber Ring Installation, Years	7	5	10		$9,724,079	$9,697,828	$ 26,251
Asset Value, Multiple of Operating Cash Flow	4	2	6		$2,145,584	$17,268,681	$ 15,123,097
Costs							
Primary Ring Cost, % of Nominal	100%	95%	120%		$9,791,884	$9,368,127	$ 423,757
Secondary Ring Cost, % of Nominal	100%	95%	140%		$9,727,648	$9,543,006	$ 184,642
SONET Hub Costs, % of Nominal	100%	80%	120%		$10,224,654	$9,189,611	$ 1,035,043
Cost of Fiber Extensions to HFC Node Sites, % of Nominal	100%	95%	140%		$9,774,760	$9,166,112	$ 608,648
Annual Equipment Replacement Costs, % of Capital Eqpt.	20%	15%	30%		$11,430,880	$6,259,638	$ 5,171,241
HFC Node Costs, % of Nominal	100%	90%	130%		$10,039,269	$8,710,721	$ 1,328,548
Coaxial Cabling Cost, % of Nominal	100%	80%	130%		$11,037,319	$7,711,852	$ 3,325,468
Coaxial Plant Equipment, % of Nominal	100%	90%	110%		$9,930,192	$9,484,072	$ 446,120
Minimal HFC Headend Equipment, % of Nominal	100%	90%	130%		$9,941,778	$9,003,196	$ 938,582
Cost per CAP Customer Fiber Lateral	100%	80%	120%		$9,874,675	$9,539,590	$ 335,085
Average Cost per Coax Drop Installation	$ 87	$ 75	$ 150		$9,945,140	$8,419,452	$ 1,525,687
Number of CAP Staff	7	5	8		$11,185,315	$8,968,041	$ 2,217,275
Number of HFC Staff	24	20	28		$12,352,331	$7,061,934	$ 5,290,397
Loan Period, Years	10	7	15		$9,916,842	$9,525,769	$ 391,073
Loan Interest Rate (Current Dollars)	8%	6%	10%		$12,029,354	$7,239,016	$ 4,790,339

Figure C1 - Tornado Diagram for Strategy 1
Lease Existing Infrastructure with Minimal Requirements

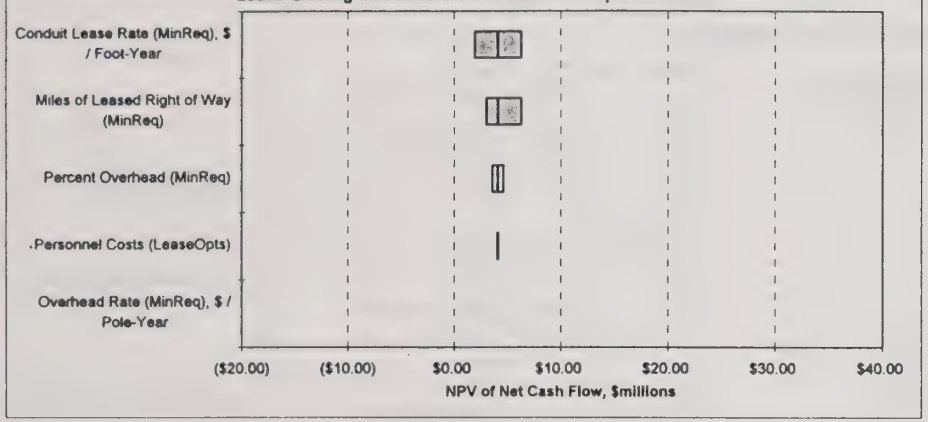


Figure C2 - Tornado Diagram for Strategy 2
Lease Existing Infrastructure with Residential Service Requirements

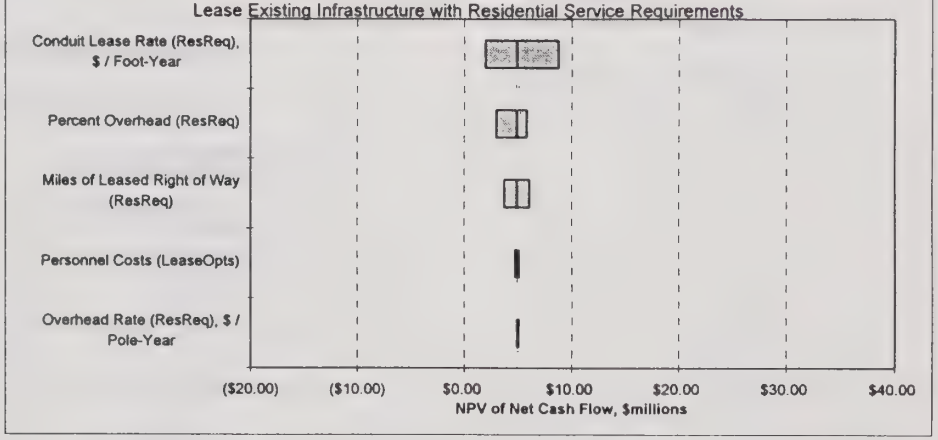


Figure C3 - Tornado Diagram for Strategy 3
Dark Fiber Backbone

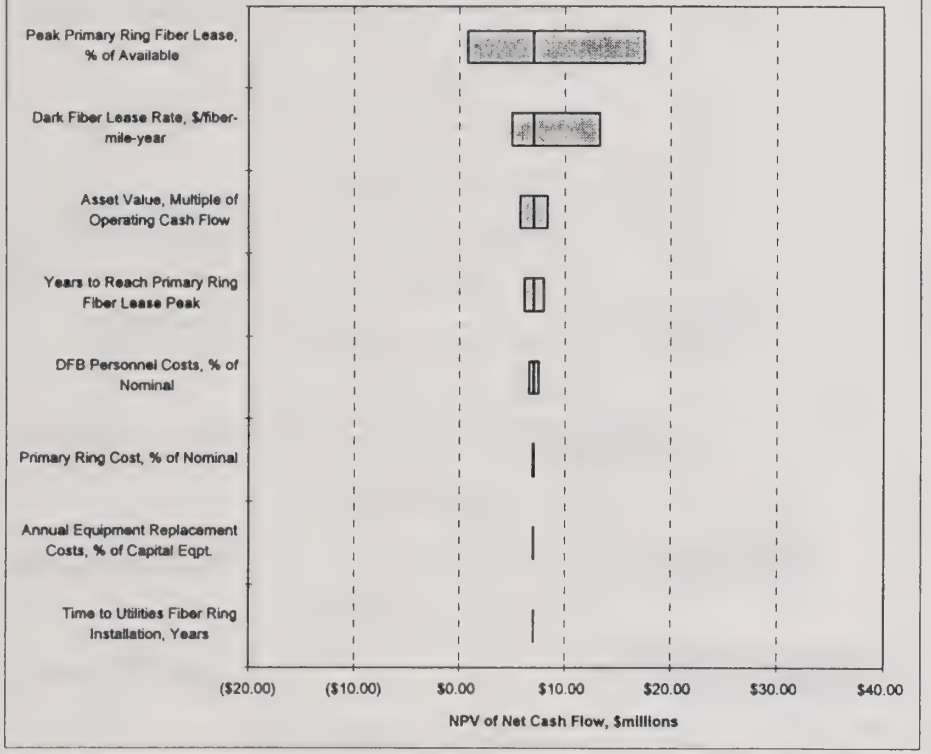


Figure C4 - Tornado Diagram for Strategy 4
Competitive Access Provider Network

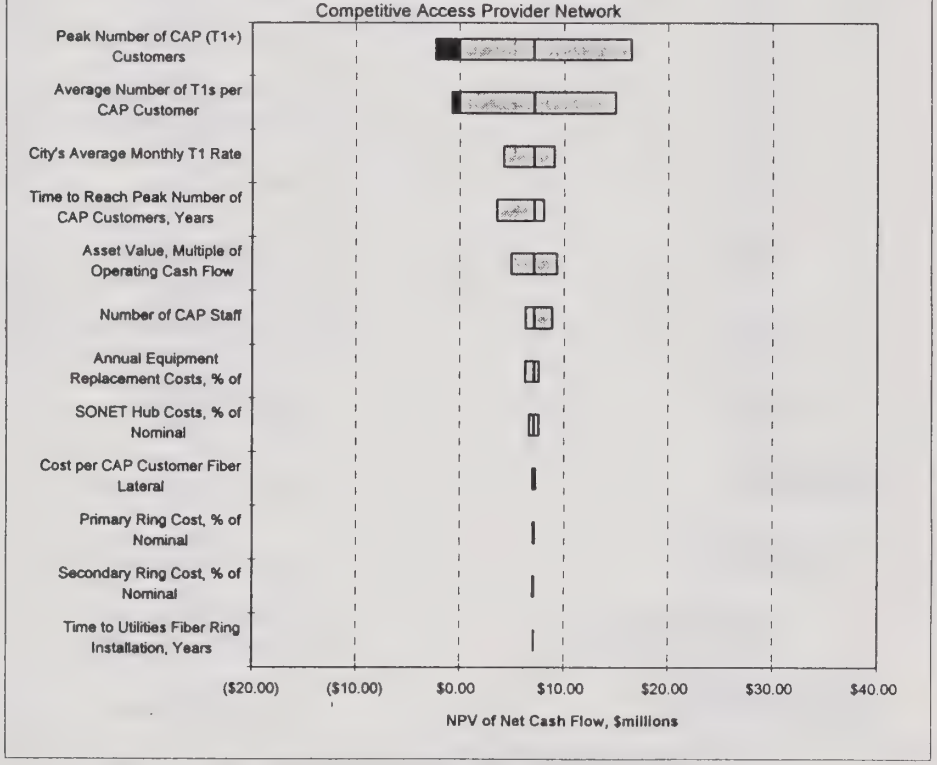


Figure C5 - Tornado Diagram for Strategy 5
Dark Fiber Backbone with Fiber Extensions for Co-op

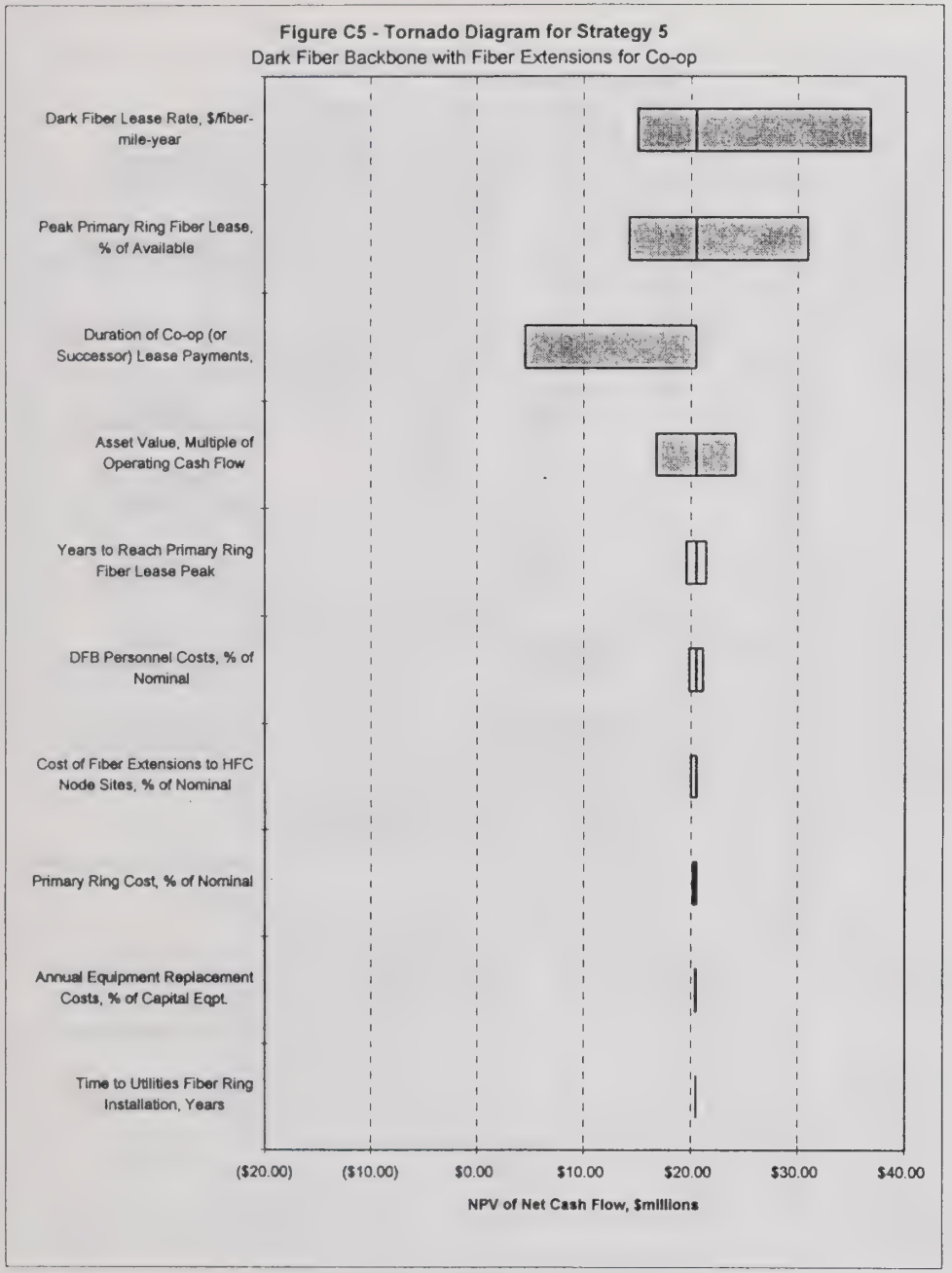
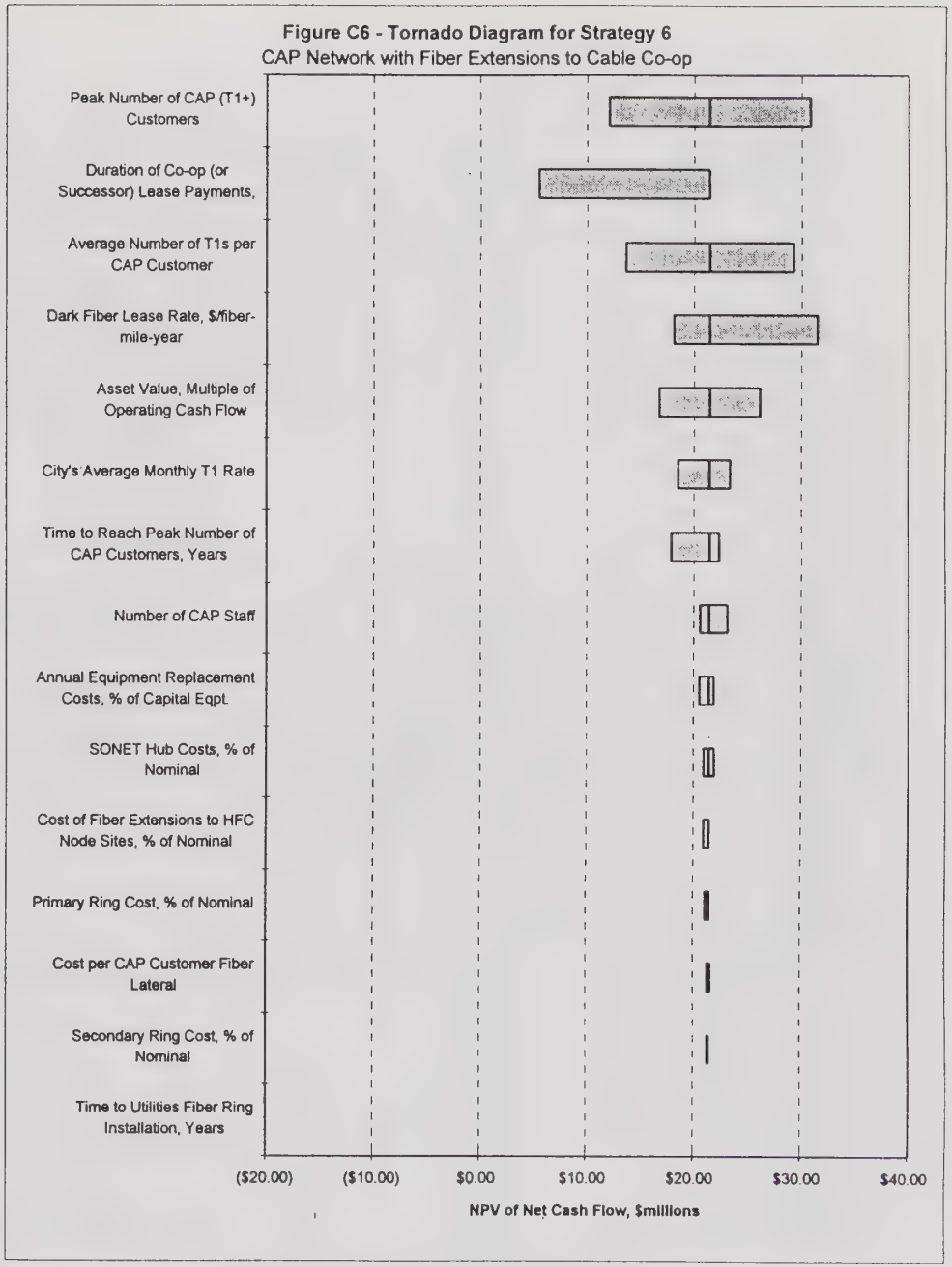


Figure C6 - Tornado Diagram for Strategy 6
CAP Network with Fiber Extensions to Cable Co-op



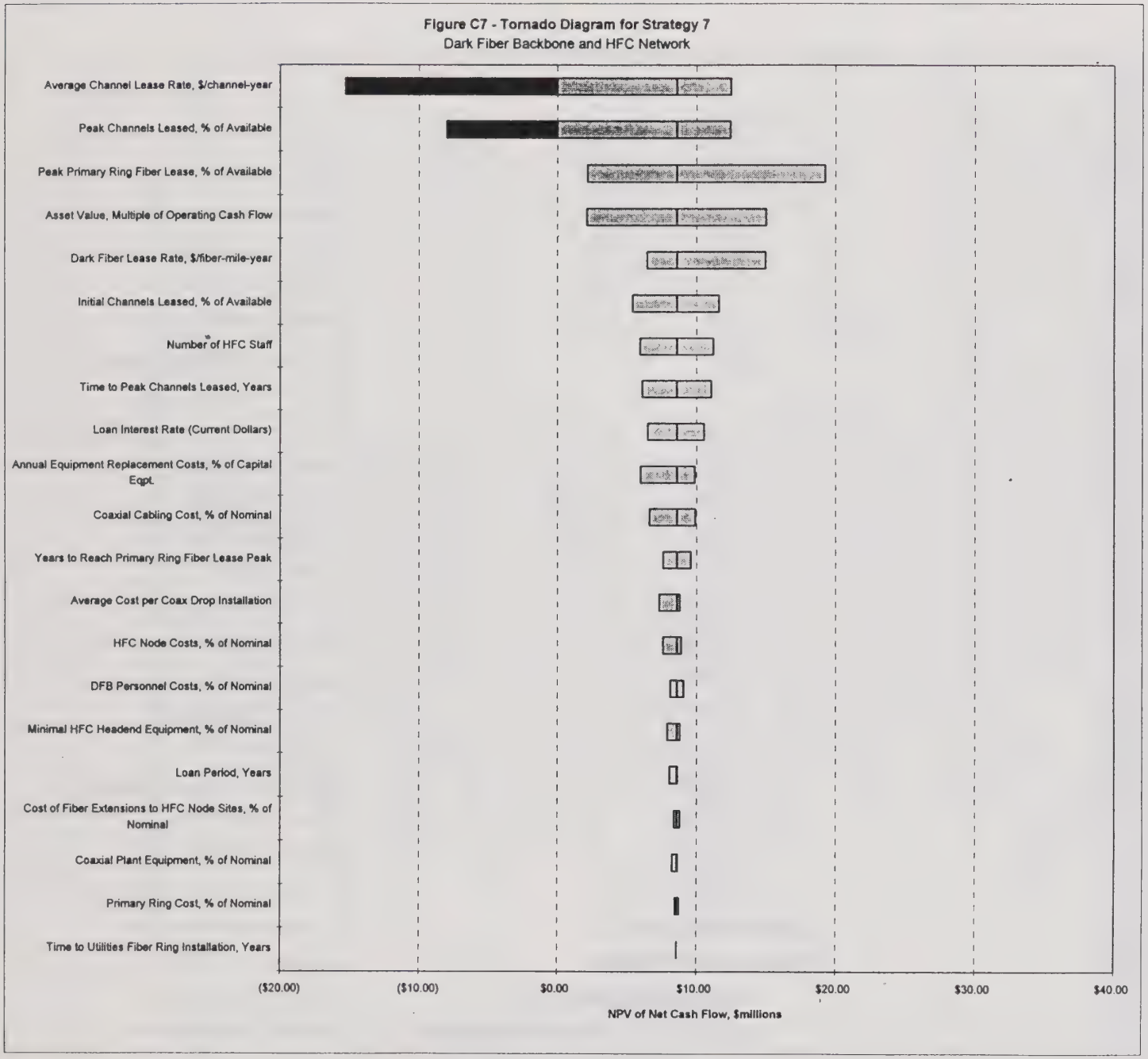


Figure C7 - Tornado Diagram for Strategy 7
Dark Fiber Backbone and HFC Network
Average Channel Lease Rate, $/channel-year
Peak Channels Leased, % of Available
Peak Primary Ring Fiber Lease, % of Available
Asset Value, Multiple of Operating Cash Flow
Dark Fiber Lease Rate, $/fiber-mile-year
Initial Channels Leased, % of Available
Number of HFC Staff
Time to Peak Channels Leased, Years
Loan Interest Rate (Current Dollars)
Annual Equipment Replacement Costs, % of Capital Eqpt.
Coaxial Cabling Cost, % of Nominal
Years to Reach Primary Ring Fiber Lease Peak
Average Cost per Coax Drop Installation
HFC Node Costs, % of Nominal
DFB Personnel Costs, % of Nominal
Minimal HFC Headend Equipment, % of Nominal
Loan Period, Years
Cost of Fiber Extensions to HFC Node Sites, % of Nominal
Coaxial Plant Equipment, % of Nominal
Primary Ring Cost, % of Nominal
Time to Utilities Fiber Ring Installation, Years
($20.00)
($10.00)
$0.00
$10.00
$20.00
$30.00
$40.00
NPV of Net Cash Flow, $millions

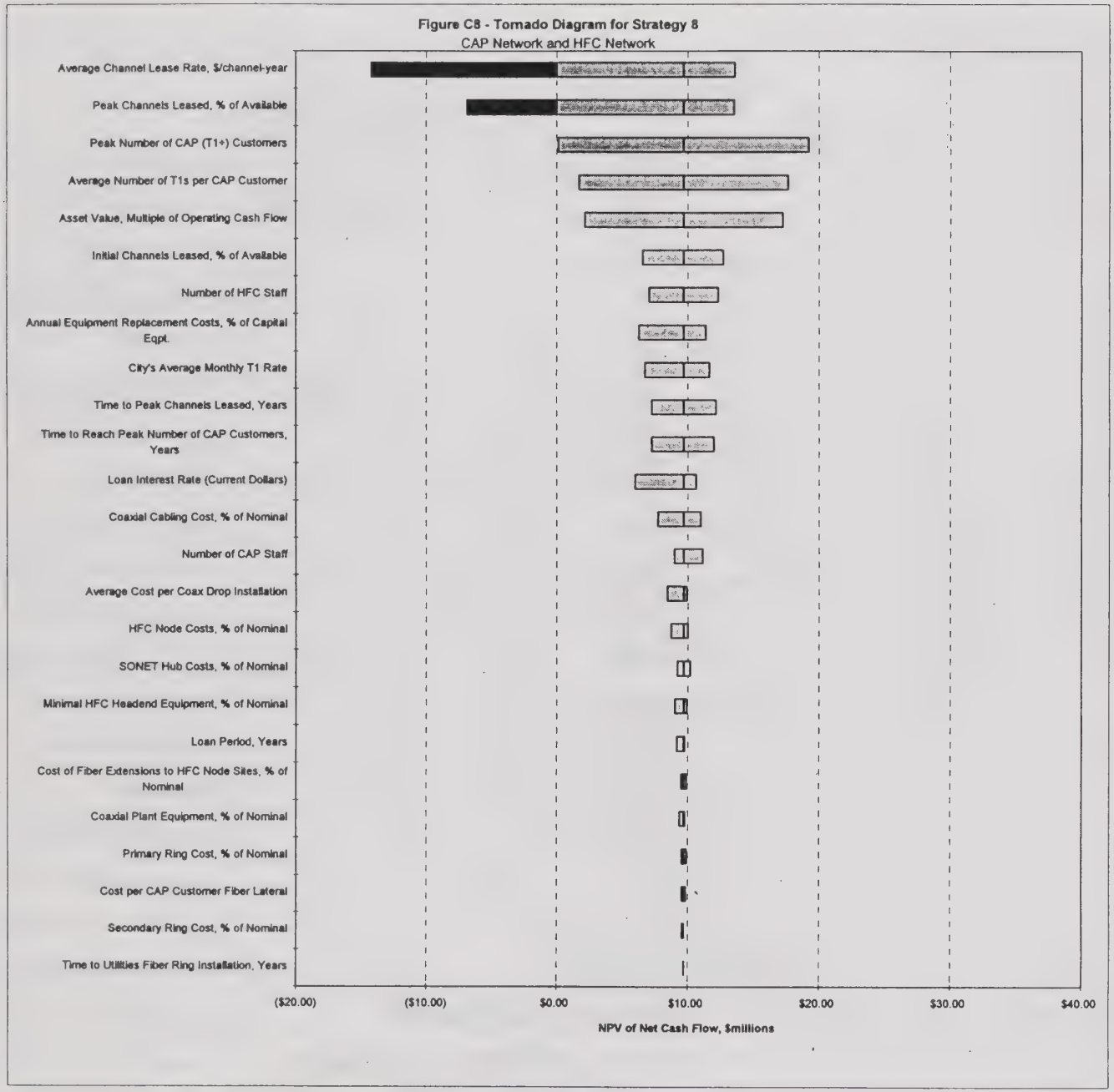


Figure C8 - Tornado Diagram for Strategy 8
CAP Network and HFC Network
Average Channel Lease Rate, $/channel-year
Peak Channels Leased, % of Available
Peak Number of CAP (T1+) Customers
Average Number of T1s per CAP Customer
Asset Value, Multiple of Operating Cash Flow
Initial Channels Leased, % of Available
Number of HFC Staff
Annual Equipment Replacement Costs, % of Capital Eqpt.
City's Average Monthly T1 Rate
Time to Peak Channels Leased, Years
Time to Reach Peak Number of CAP Customers, Years
Loan Interest Rate (Current Dollars)
Coaxial Cabling Cost, % of Nominal
Number of CAP Staff
Average Cost per Coax Drop Installation
HFC Node Costs, % of Nominal
SONET Hub Costs, % of Nominal
Minimal HFC Headend Equipment, % of Nominal
Loan Period, Years
Cost of Fiber Extensions to HFC Node Sites, % of Nominal
Coaxial Plant Equipment, % of Nominal
Primary Ring Cost, % of Nominal
Cost per CAP Customer Fiber Lateral
Secondary Ring Cost, % of Nominal
Time to Utilities Fiber Ring Installation, Years
($20.00)
($10.00)
$0.00
$10.00
$20.00
$30.00
$40.00
NPV of Net Cash Flow, $millions

Table C17 lists the variables whose uncertainty was considered to be significant.

Strategy	Significant Uncertain Variables	NPV Swing ($millions)
1 - Lease Existing Infrastructure with Minimal Requirements	• Conduit Lease Rate, $/ft-yr. • Miles of Leased Right of Way	$4.4 $3.3
2 - Lease Existing Infrastructure with Residential Service Requirements	• Conduit Lease Rate, $/ft-yr. • Percent of Leased Infrastructure Overhead	$6.8 $2.9
3 - Dark Fiber Backbone	• Peak Percent of Primary Ring Fibers Leased • Dark Fiber Lease Rate, $/fiber-mile • Asset Value, Multiple of Operating Cash Flow	$16.8 $8.4 $2.7
4 - Competitive Access Provider (CAP) Network	• Peak Number of CAP (T1+) Customers • Average Number of T1s per Customer • Asset Value, Multiple of Operating Cash Flow	$18.8 $15.7 $4.4
5 - Dark Fiber Backbone with Dark Fiber Extensions for Cable Co-op	• Dark Fiber Lease Rate, $/fiber-mile • Peak Percent of Primary Ring Fibers Leased • Duration of Co-op (or Successor) Lease Payments, yrs. • Asset Value, Multiple of Operating Cash Flow	$21.8 $16.8 $16.0 $7.5
6 - CAP Network with Dark Fiber Extensions for Cable Co-op	• Peak Number of CAP (T1+) Customers • Duration of Co-op (or Successor) Lease Payments, yrs. • Average Number of T1s per Customer • Dark Fiber Lease Rate, $/fiber-mile • Asset Value, Multiple of Operating Cash Flow	$18.8 $16.0 $15.6 $13.4 $9.5
7 - Dark Fiber Backbone and Hybrid Fiber-Coax Network	• Average HFC Channel Lease Rate, $/channel-yr. • Peak Percent of HFC Channels Leased • Peak Percent of Primary Ring Fibers Leased • Asset Value, Multiple of Operating Cash Flow • Dark Fiber Lease Rate, $/fiber-mile	$27.9 $20.5 $17.1 $12.9 $8.6
8 - CAP Network and Hybrid Fiber-Coax Network	• Average HFC Channel Lease Rate, $/channel-yr. • Peak Percent of HFC Channels Leased • Peak Number of CAP (T1+) Customers • Average Number of T1s per Customer • Asset Value, Multiple of Operating Cash Flow	$27.8 $20.4 $19.1 $15.9 $15.1

Table C17 - List of Significant Uncertain Variables for Each Strategy

C.6. Probabilistic Analysis

A probabilistic analysis was implemented using a combination of decision analysis and simulation (e.g., Monte Carlo simulation) techniques. Decision analysis techniques were used to frame the problem as shown in the decision tree in Figure C9. Simulation was then used to probabilistically analyze the problem using this framework.

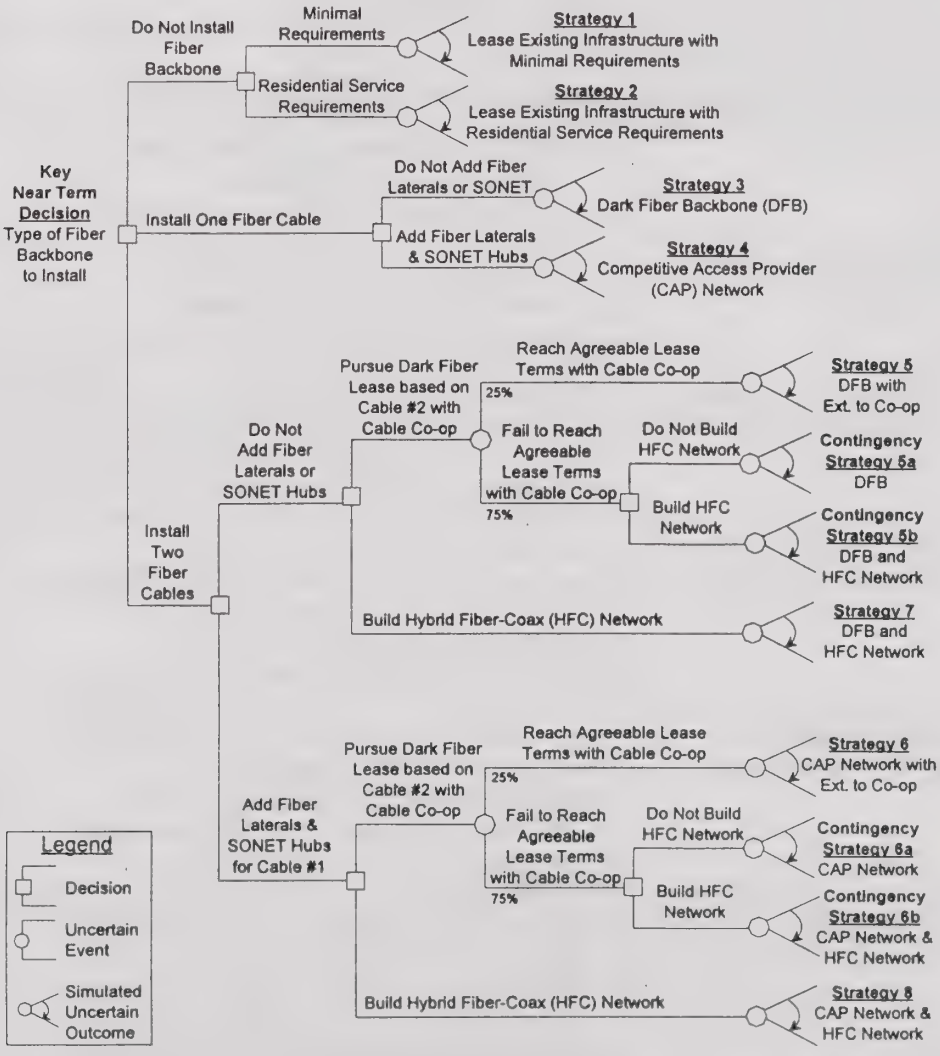


Figure C9 - Telecommunications Strategy Decision Tree

A software package, *Crystal Ball*, was used to simulate the impact of uncertainty on the endpoints in Figure C9. The deterministic financial models were converted to probabilistic models by subjectively assessing probability distributions for each of the significant uncertain variables listed in Table C17. The probability distributions used are as follows:

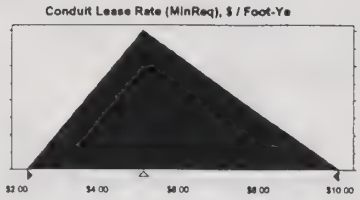
Probability Distributions Assumed for Significant Uncertain Variables (Page 1 of 4)

Assumption: Conduit Lease Rate (MinReq), $ / Foot-Year **Cell: D13**

Triangular distribution with parameters:

Minimum	$2.00
Likeliest	$5.00
Maximum	$10.00

Selected range is from $2.00 to $10.00
Mean value in simulation was $5.67

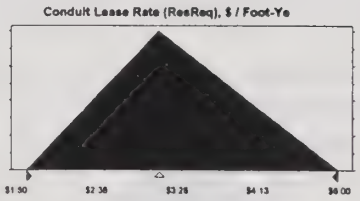


Assumption: Conduit Lease Rate (ResReq), $ / Foot-Year **Cell: D23**

Triangular distribution with parameters:

Minimum	$1.50
Likeliest	$3.00
Maximum	$5.00

Selected range is from $1.50 to $5.00
Mean value in simulation was $3.17



Assumption: Dark Fiber Lease Rate, $/fiber-mile-year **Cell: D30**

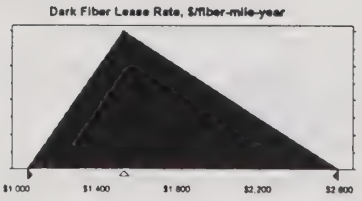
Triangular distribution with parameters:

Minimum	$1,000
Likeliest	$1,500
Maximum	$2,600

Selected range is from $1,000 to $2,600
Mean value in simulation was $1,700

Correlated with:

Peak Primary Ring Fiber Lease, % of Avai (D31)	-0.50
Duration of Co-op (or Successor) Lease P (D65)	-0.25



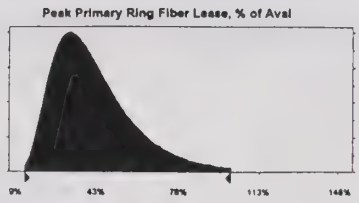
Probability Distributions Assumed for Significant Uncertain Variables (Page 2 of 4)

Assumption: Peak Primary Ring Fiber Lease, % of Available **Cell: D31**

Lognormal distribution with parameters:

Mean	40%
Standard Dev.	20%

Selected range is from 0% to 100%
Mean value in simulation was 39%



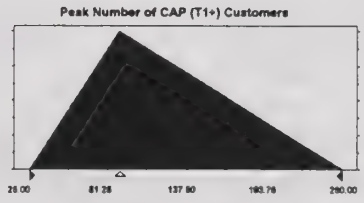
Correlated with:
Dark Fiber Lease Rate, $/fiber-mile-year (D30 -0.50

Assumption: Peak Number of CAP (T1+) Customers **Cell: D44**

Triangular distribution with parameters:

Minimum	25.00
Likeliest	90.00
Maximum	250.00

Selected range is from 25.00 to 250.00
Mean value in simulation was 121.64

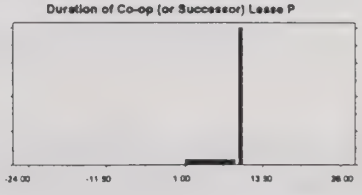


Assumption: Duration of Co-op (or Successor) Lease Payments, yrs. **Cell: D65**

Custom distribution with parameters:			Relative Prob.
Continuous range	1.00 to	9.00	0.250000
Single point	10.00		0.750000
Total Relative Probability			1.000000

Mean value in simulation was 8.75

Correlated with:
Dark Fiber Lease Rate, $/fiber-mile-year (D30 -0.25

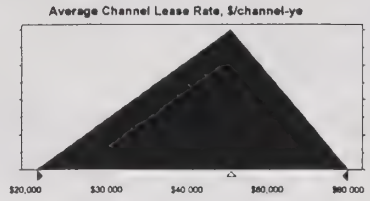


Probability Distributions Assumed for Significant Uncertain Variables (Page 3 of 4)

Assumption: Average Channel Lease Rate, $/channel-year **Cell: D102**

Triangular distribution with parameters:

Minimum	$20,000
Likeliest	$45,000
Maximum	$60,000



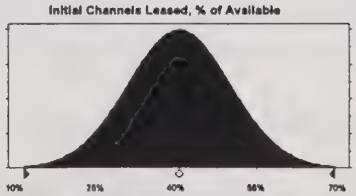
Selected range is from $20,000 to $60,000
Mean value in simulation was $41,665

Correlated with:
Peak Channels Leased, % of Available (D104 -0.50

Assumption: Initial Channels Leased, % of Available **Cell: D103**

Normal distribution with parameters:

Mean	40%
Standard Dev.	10%

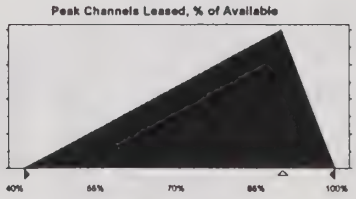


Selected range is from 0% to 70%
Mean value in simulation was 40%

Assumption: Peak Channels Leased, % of Available **Cell: D104**

Triangular distribution with parameters:

Minimum	40%
Likeliest	90%
Maximum	100%



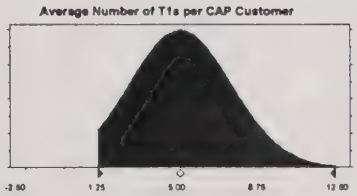
Selected range is from 40% to 100%
Mean value in simulation was 77%

Correlated with:
Average Channel Lease Rate, $/channel-ye (-0.50

Assumption: Average Number of T1s per CAP Customer **Cell: D46**

Normal distribution with parameters:

Mean	5.00
Standard Dev.	2.50



Selected range is from 1.00 to +Infinity
Mean value in simulation was 5.30

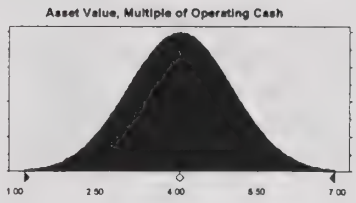
Probability Distributions Assumed for Significant Uncertain Variables (Page 4 of 4)

Assumption: Asset Value, Multiple of Operating Cash Flow **Cell: D35**

Normal distribution with parameters:

Mean	4.00
Standard Dev.	1.00

Selected range is from 1.00 to 7.00
Mean value in simulation was 4.00

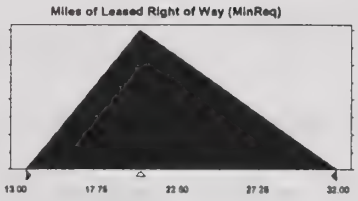


Assumption: Miles of Leased Right of Way (MinReq) **Cell: D10**

Triangular distribution with parameters:

Minimum	13.00
Likeliest	20.00
Maximum	32.00

Selected range is from 13.00 to 32.00
Mean value in simulation was 21.67

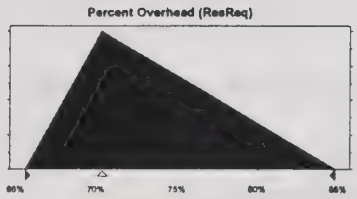


Assumption: Percent Overhead (ResReq) **Cell: D21**

Triangular distribution with parameters:

Minimum	65%
Likeliest	70%
Maximum	85%

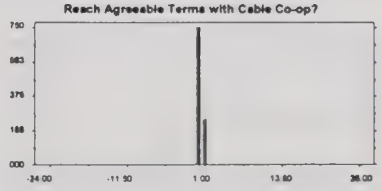
Selected range is from 65% to 85%
Mean value in simulation was 73%



Assumption: Reach Agreeable Terms with Cable Co-op? **Cell: D166**

Custom distribution with parameters:		Relative Prob.
Single point	0.00	0.750000
Single point	1.00	0.250000
Total Relative Probability		1.000000

Mean value in simulation was 0.25



The resulting simulated outcomes for the endpoints in Figure C9 are summarized in Figure C10 as eight primary strategies and four contingency strategies. The range from the bottom to the top of a given bar spans the full range of possible outcomes for that strategy. The top dark-shaded portion of the bar for a given strategy represents the highest 10% of possible outcomes; the bottom dark-shaded portion represents the lowest 10%. This implies that there is a 10% chance that the actual NPV will be greater than the NPV at the 90% point and a 10% chance that the actual NPV will be less than the 10% point. The light-shaded portion in the middle, therefore, represents a range over which the actual NPV has an 80% chance of occurring. The dark horizontal line is the probabilistic expected value of the distribution of outcomes. It is the average value of all of the outcomes in the simulation.

Strategies 1 and 2, the Lease Existing Infrastructure strategies, represent the lowest risk, but also the lowest upside potential. Strategies 3 and 5 are also very low risk because the City is able to limit its investment by providing only fiber optic cable with very limited staffing. Strategies 4 and 6 offer tremendous upside potential in the Competitive Access Provider market, but involve

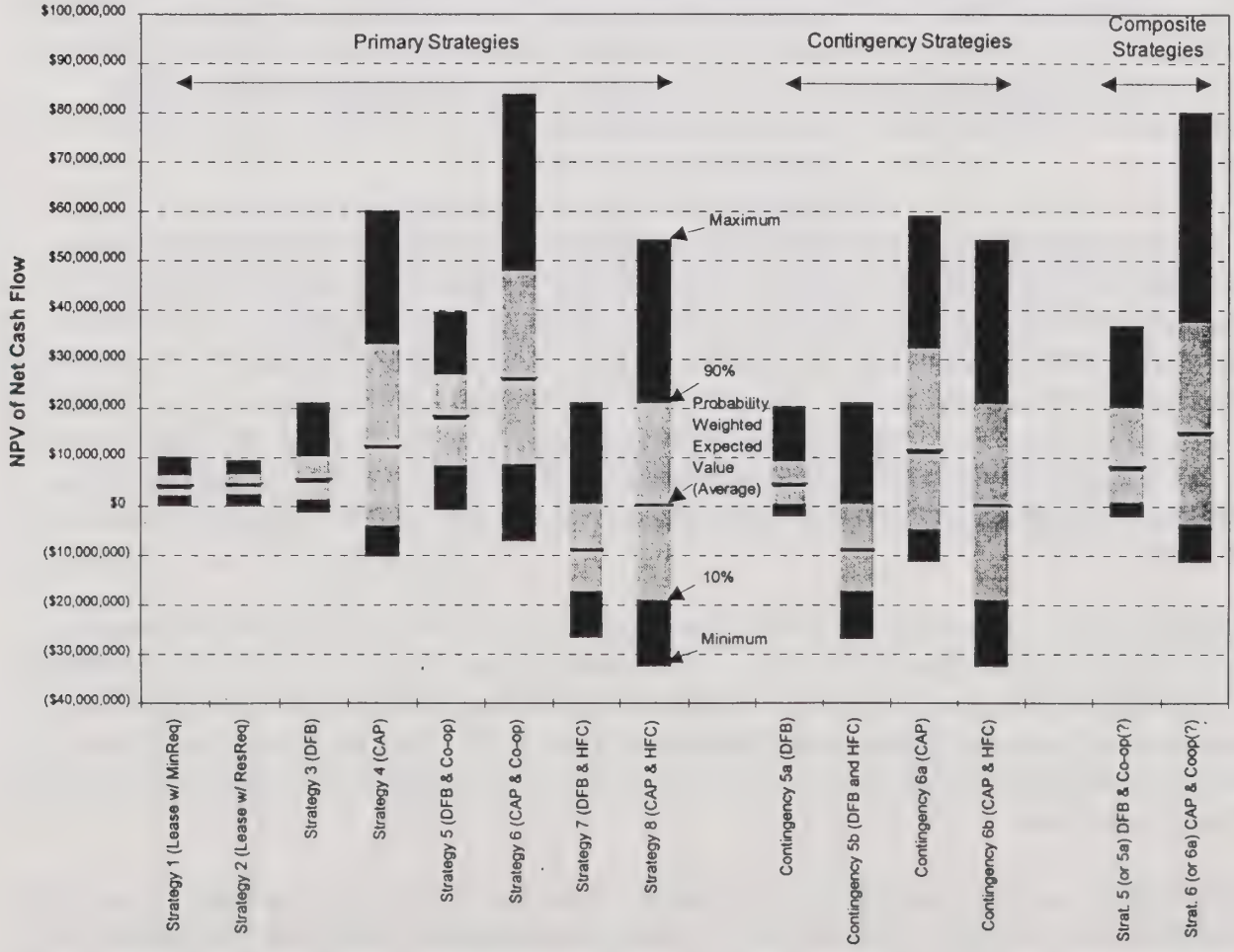


Figure C10 - Statistical Summary of Simulated Outcomes

more risk due to the need to invest more in infrastructure and staffing and the need to prove to large customers that it can reliably carry their critical telecommunications traffic. A partner could potentially reduce the risk associated with these strategies. Strategies 7 and 8 are the highest risk strategies due to the high capital investment needed to construct infrastructure in the residential districts in Palo Alto. They would certainly require a partner.

In the primary strategies shown in Figure C10, Strategies 5 and 6 assume that the City will reach acceptable lease terms with Cable Co-op (or their successor) and lease fiber for at least one year and most likely ten or more years. However, it will not likely be known in advance of the August Council meeting if the City will be able to reach acceptable lease terms with Cable Co-op. The contingency strategies are strategies that could be pursued in the event that the City installs a fiber cable with the intent of leasing its fibers to Cable Co-op but fails to come to agreement on lease terms.

Contingency Strategy 5a demonstrates the limits on the risk associated with installing fiber before reaching agreeable terms with Cable Co-op. It assumes that the fibers in the $833,000 cable installed for Cable Co-op are never used and sit idle, generating no revenues (an unlikely scenario -- but clearly a worst case) and that the City incurred costs of $50,000 during the failed negotiation process. As is shown, the anticipated revenues from leasing the Dark Fiber Backbone would offset this cost and make it highly unlikely that the City would suffer an overall loss.

The two composite strategies at the far right of Figure C10 are based on the City pursuing Strategy 5 or 6 combined with a belief that there is a 75% chance that the City will not be able to reach agreeable lease terms with Cable Co-op. In the event that an agreement is not reached, these composite strategies assume that the City pursues Contingency Strategy 5a or 6a and never uses the fiber cable installed for Cable Co-op. These strategies identify the probability-weighted results of installing two fiber cables in the face of this uncertainty. As is shown, the risk exposure is minimal if the City pursues a Dark Fiber Backbone-based approach, and small relative to the upside potential if the City pursues a Competitive Access Provider-based approach.

Although a full range of strategies were evaluated, the City Council will be most interested in those strategies that address the needs of all customer classes with limited risk. The cumulative probability distributions for the three strategies that most successfully meet these competing interests are presented as risk-reward profiles in Figure C11. These risk-reward profiles can be used to identify the probability that the outcome of a given strategy will be greater than or less than a given value.

Given these results, if the City wishes to position itself to help deliver the maximum community benefits while limiting its financial risk, it should simultaneously install two fiber cables with high fiber counts and continue to examine how to best use them to benefit the community while

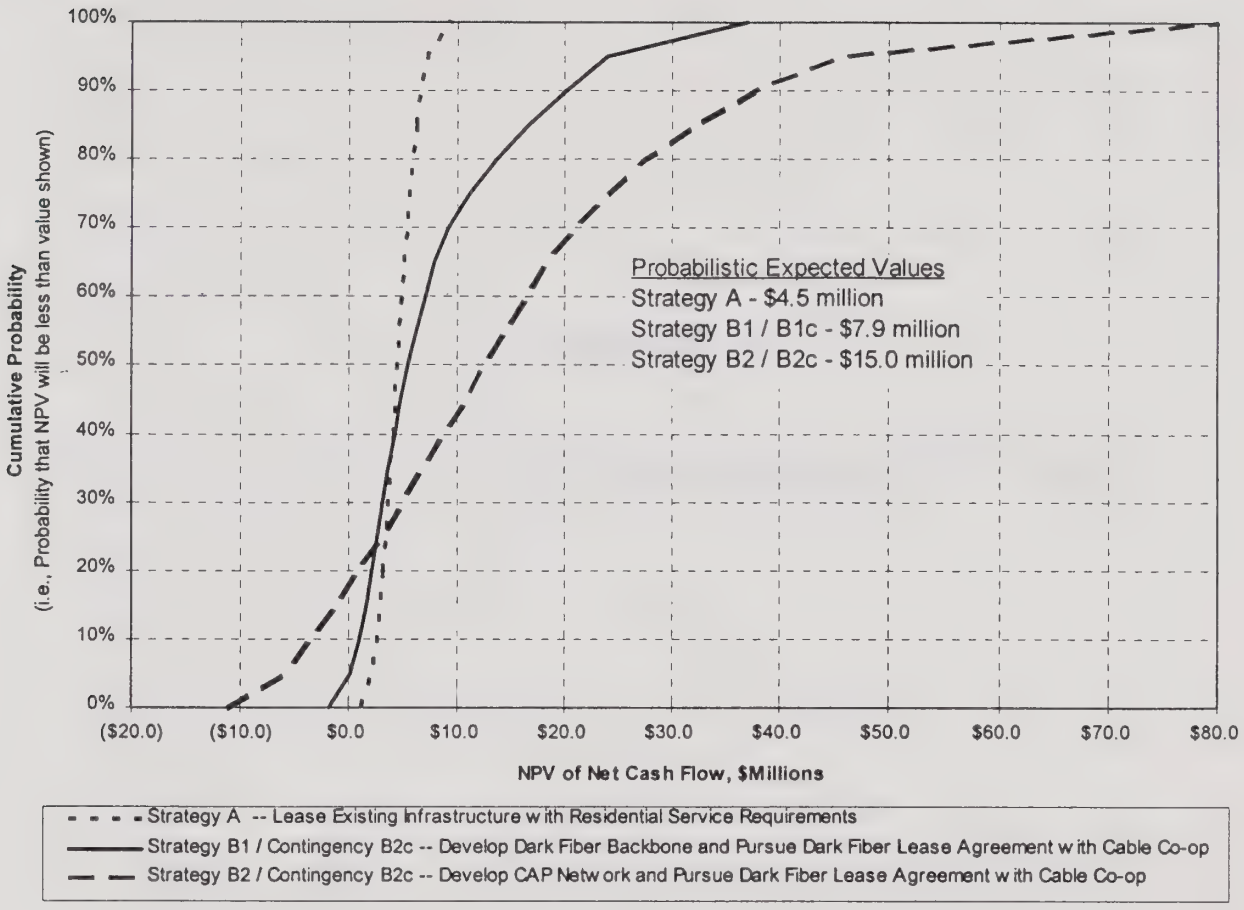


Figure C11 - Detailed Risk-Reward Profile Comparison

they are being installed. This would position the City to pursue Strategy 5, Strategy 6, or something else entirely should an opportunity present itself. However, if the City's sole objective is to minimize risk, it could instead pursue Strategy 2 and lease existing infrastructure with residential service requirements.

APPENDIX D

Financial Model for the Recommended Strategy

Table D1 (Page 1 of 2)
FINANCIAL MODEL
Recommended Positioning Strategy - Dark Fiber Backbone

Primary Ring Fibers Available for Lease	240	
Fibers Reserved for City Use	8	
Length per Primary Ring Fiber, miles	15	
Total Fiber-Miles Available for Lease	3480	
Lease Rate, $/fiber-mile-yr	$ 1,500	
Peak Leased Fiber-Miles, Percent of Total	25%	(58 fibers)
Yrs. of Growth to Peak Leased Fiber-Miles	3	
Anticipated Utilities Fiber Installation, years	7	
Asset Value, Multiple of Operating Cash Flow	4	

Deterministic Sensitivity Analysis							
		Sensitivity Analysis Results					
Input Sensitivity Values		NPV of Net Cash Flow		Payback Period, Years		Mature Annual Cash Flows	
Low	High	Low	High	Low	High	Low	High
$1,000	$2,000	$ 4,862,393	$14,073,211	5	3	$ 659,200	$ 1,529,200
10%	40%	$ 1,175,900	$17,757,538	10	3	$ 311,200	$ 2,400,600
1	5	$10,740,127	$ 8,227,234	3	5	$ 1,094,200	$ 1,094,200
5	10	$ 9,474,307	$ 9,420,745	4	4	$ 1,094,200	$ 1,094,200
2	6	$ 7,573,624	$11,361,980	4	4	$ 1,094,200	$ 1,094,200

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Annual Income (1996 Dollars)										
Percent of Fibers Leased	0%	8%	17%	25%	25%	25%	25%	25%	25%	25%
Total Revenues	$ -	$ 435,000	$ 870,000	$ 1,305,000	$ 1,305,000	$ 1,305,000	$ 1,305,000	$ 1,305,000	$ 1,305,000	$ 1,305,000
Annual Expenses (1996 Dollars)										
Construction Costs										
Primary Fiber Ring	$ 675,678	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
HFC Fiber Parallel to Primary Fiber RIng	$ 832,890	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Other Network Costs										
Maintenance Vehicles [1]	$ 25,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Equipment [2]	$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Equipment Replacement Costs [3]	$ -	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Building Space Leased from City	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000
New FTE Staff Costs										
Salaries [4]	$ 80,000	$ 130,000	$ 130,000	$ 130,000	$ 130,000	$ 130,000	$ 130,000	$ 130,000	$ 130,000	$ 130,000
Benefits (33%)	$ 26,400	$ 42,900	$ 42,900	$ 42,900	$ 42,900	$ 42,900	$ 42,900	$ 42,900	$ 42,900	$ 42,900
Training / Technical Support (3%)	$ 2,400	$ 3,900	$ 3,900	$ 3,900	$ 3,900	$ 3,900	$ 3,900	$ 3,900	$ 3,900	$ 3,900
Other Professional Costs										
Construction Oversight and Inspection	$ 110,000									
Outside Legal Counsel	$ 50,000									
Miscellaneous [5]		$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Total Costs	$ 1,856,368	$ 210,800	$ 210,800	$ 210,800	$ 210,800	$ 210,800	$ 210,800	$ 210,800	$ 210,800	$ 210,800
Cash Flow (1996 Dollars)	$(1,856,368)	$ 224,200	$ 659,200	$ 1,094,200	$ 1,094,200	$ 1,094,200	$ 1,094,200	$ 1,094,200	$ 1,094,200	$ 1,094,200

Table D1 (Page 2 of 2)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Cash Flow (Current Dollars) [6]	$(1,856,368)	$ 233,168	$ 712,991	$ 1,230,826	$ 1,280,059	$ 1,331,262	$ 1,384,512	$ 1,439,893	$ 1,497,488	$ 1,557,388
Electric Utility Financial Involvement (Current Dollars)										
Repayment of all Telecom Study Costs	$ (200,000)									
Avoided Utilities Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ 237,635	$ -	$ -	$ -
Startup Loan (from Utility Reserves)										
Balance at Start of Year	$ -	$ 2,179,750	$ 2,077,367	$ 1,489,018	$ 347,533	$ -	$ -	$ -	$ -	$ -
Loan Amount (Start of Year)	$ 2,056,368	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest (6%)	$ 123,382	$ 130,785	$ 124,642	$ 89,341	$ 20,852	$ -	$ -	$ -	$ -	$ -
Loan Payments	$ -	$ (233,168)	$ (712,991)	$(1,230,826)	$ (368,385)	$ -	$ -	$ -	$ -	$ -
Residual Value of Assets (Current Dollars)										
Sale of Assets [7]										$ 6,400,349
Retirement of Outstanding Debt										$ -
Net Cash Flow (Current Dollars)	$ -	$ -	$ -	$ -	$ 911,674	$ 1,331,262	$ 1,622,147	$ 1,439,893	$ 1,497,488	$ 7,957,736
NPV of Net Cash Flow (10 yr. @ 6%)	$ 9,467,802									

Notes

[1] Assumes 1 equipped pickup truck at $25,000 and 1 bucket truck available from Utilities for limited usage at no charge.

[2] OTDR test equipment at $10,000 and a fusion splicer at $40,000.

[3] Assumed to be 20% of total capital equipment, not including fiber infrastructure.

[4] Costs cover 1 manager ($80,000/yr) and 1 fiber technician ($50,000/yr starting in Year 2).

[5] Miscellaneous costs include anticipated costs such as cross-departmental and cross divisional charges as well unexpected costs.

[6] A 4% inflation rate was assumed to escalate Constant (1996) Dollar net cash flows to Current Dollar net cash flows.

[7] All assets purchased in Years 1-10 are assumed to be sold at the end of Year 10 for a multiple of operating cash flow (defined as the difference between revenue and all expenses before capital, interest, depreciation, and taxes) to account for the remaining value of newly developed assets. Although telecommunications network such as cable television historically sold at 7 to 12 times operating cash flow, a multiple of 4 was conservatively assumed to account for the fact that the network will not be a quasi-monopoly, will not have market dominance, and will face multiple well-financed, virtually unregulated competitors. Also, the assumed growth of the media businesses has strongly influenced their market values. The growth rate of this pure transport business will likely have far less appeal, especially by the year 2007. Finally, the fiber will be located in conduits shared with the Electric Utility and, as a result, would be assessed a lower value than fibers in a discrete network.

Fund: Electric Fund
Functional Area: Commercial Telecommunications

To promote the formation of a competitive market for telecommunications services in Palo Alto to the benefit of the Electric Utility and the citizens, businesses, and other institutions of Palo Alto.

KEY PLANS

- ❒ Design and construct a fiber optic ring around Palo Alto by the end of the first quarter of FY 1997-98.
- ❒ Negotiate "Early Market Entrant" agreements with telecommunications network developers and service providers prior to the completion of fiber ring construction.
- ❒ Evaluate additional fiber optic cable deployment opportunities that would support the needs of network developers and service providers.
- ❒ Coordinate and implement a marketing effort on behalf of all companies that have "Early Market Entrant" agreements with the Electric Utility

MAJOR ACTIVITIES	1995-96 ADJUSTED BUDGET	1996-97 ADOPTED BUDGET	1996-97 BUDGET CHANGE	1996-97 ADJUSTED BUDGET	1996-97 BUDGET CHANGE
Planning/Marketing/Contract Negotiations	$0	$0	$0	$88,600	$88,600
Operations/Maintenance	0	0	0	10,000	10,000
Design Construction - CIP	0	0	0	1,998,400	1,998,400
TOTAL EXPENDITURES	$0	$0	$0	$2,097,000	$2,097,000
FULL TIME POSITIONS	0.00	0.00	0.00	.3	.3
TEMPORARY POSITIONS	0.00	0.00	0.00	0.00	0.00
TOTAL REVENUE	$0	$0	$0	$0	$0

Functional Area: Commercial Telecommunications
Summary of 1996-97 Regular Positions
by Major Activity

MAJOR ACTIVITIES

Planning/Marketing/Contract Negotiations

0.2	Resource Planner
0.2	**Subtotal FTE for Major Activity**

Design/Construction

0.1	Resource Planner
0.1	**Subtotal FTE for Major Activity**

.3	**TOTAL FUNCTIONAL AREA POSITIONS**

Major Activity: Planning/Marketing/Contract Negotiations

To pursue and evaluate opportunities and negotiate contracts with telecommunications network developers and service providers.

	1995-96 ADJUSTED BUDGET	1996-97 ADOPTED BUDGET	1996-97 BUDGET CHANGE	1996-97 ADJUSTED BUDGET	1997-98 BUDGET CHANGE
Salaries and Benefits	$0	$0	$0	$17,600	$17,600
Non-Salaries	0	0	0	65,000	65,000
Allocated Expenses	0	0	0	6,000	6,000
TOTAL EXPENDITURES	$0	$0	$0	$88,600	$88,600
FULL TIME POSITIONS	0.00	0.00	0.00	0.2	0.2
TEMPORARY POSITIONS	0.00	0.00	0.00	0.00	0.00

IMPACT MEASURES	1995-96 ADJUSTED BUDGET	1995-96 ESTIMATED ACTUALS	1996-97 PROPOSED BUDGET	1996-97 ADJUSTED BUDGET
1. Negotiate agreements for the lease of at least 10% of the fibers installed	n/a	n/a	n/a	10%
2. Negotiate agreements that will recover at least 10% of construction cost annually.	n/a	n/a	n/a	10%

Major Activity: Operations/Maintenance

To maintain fiber ring integrity and rapidly respond to interconnection requests and outage notifications.

	1995-96 ADJUSTED BUDGET	1996-97 ADOPTED BUDGET	1996-97 BUDGET CHANGE	1996-97 ADJUSTED BUDGET	1996-97 BUDGET CHANGE
Salaries and Benefits	$0	$0	$0	$0	$0
Non-Salaries	0	0	0	10,000	10,000
Allocated Expenses	0	0	0	0	0
TOTAL EXPENDITURES	$0	$0	$0	$10,000	$10,000
FULL TIME POSITIONS	0.00	0.00	0.00	0.00	0.00
TEMPORARY POSITIONS	0.00	0.00	0.00	0.00	0.00

IMPACT MEASURES	1995-96 ADJUSTED BUDGET	1995-96 ESTIMATED ACTUALS	1996-97 PROPOSED BUDGET	1996-97 ADJUSTED BUDGET
1. Respond to 100% of outages within 4 hours of notification.	n/a	n/a	n/a	100%/4

Major Activity: Design/Construction-CIP

To design and construct a fiber optic ring around Palo Alto.

	1995-96 ADJUSTED BUDGET	1996-97 ADOPTED BUDGET	1996-97 BUDGET CHANGE	1996-97 ADJUSTED BUDGET	1997-98 BUDGET CHANGE
Salaries and Benefits	$0	$0	$0	$33,800	$33,800
Non-Salaries	0	0	0	1,961,600	1,961,600
Allocated Expenses	0	0	0	3,000	3,000
TOTAL EXPENDITURES	$0	$0	$0	$1,998,400	$1,998,400
FULL TIME POSITIONS	0.00	0.00	0.00	0.1	0.1
TEMPORARY POSITIONS	0.00	0.00	0.00	0.00	0.00

IMPACT MEASURES	1995-96 ADJUSTED BUDGET	1995-96 ESTIMATED ACTUALS	1996-97 PROPOSED BUDGET	1996-97 ADJUSTED BUDGET
1. Finalize fiber ring design within 4 months of project approval.	n/a	n/a	n/a	4
2. Complete construction of the fiber ring within 15 months of project approval.	n/a	n/a	n/a	15
3. Complete construction at or below budgeted cost.	n/a	n/a	n/a	Yes

Fiber Optic Design and Construction (19716) - New
Commercial Telecommunications - Design/Construction-CIP

PROJECT DESCRIPTION

This project will design and construct a "dark" fiber optic ring around Palo Alto, which will in turn be leased to parties providing telecommunication services to citizens and businesses in Palo Alto. Additional fibers will be reserved for future use by the City. The fiber cable is called "dark" because it consists only of strands of glass without any light transmitters, receivers, or associated electronics. In order for the fiber cable to be used to transmit information, this additional electronic equipment will need to be installed by the users or lessors. Fiber optic cable is used for higher speed, lower cost telecommunication transmissions than traditional wiring, and can be used to transmit voice, video and data information. Such transmissions are becoming increasingly important as a result of the expanding use of electronic information. The City owns the conduit and poles necessary to construct such a ring, and thus avoids the need for boring underground to install new conduit.

PROJECT JUSTIFICATION

This project will promote the formation of a competitive market for telecommunications in Palo Alto, accelerating the pace at which high-quality, low-cost advanced telecommunications services are delivered to the residents and businesses of Palo Alto. It does so while limiting the negative impacts on Palo Alto's environment by using pre-existing conduit and poles. Finally, it will enable the Electric Utility to generate additional revenues through the enhanced use of its conduit and poles. It is projected that lease revenues from the fiber optic ring could enable the Electric Utility to recover its costs within three to five years.

FUTURE FINANCIAL REQUIREMENTS

FISCAL YEAR	AMOUNT	COMPONENTS
PY Budget	Ongoing	
1996-97	$1,995,400	Fiber ring design and construction
1997-98		
1998-99		
1999-00		
2000-01		

Sources of Funding: Electric Fund

IMPACT AND SUPPORT ANALYSIS

- Environmental: An Environmental Assessment will be required. The study will focus on visual, aesthetics and long range implications of the installation of the fiber optic ring.
- Design Elements: The fiber optic ring will have minimal initial design impacts as the fiber optics will be placed underground where underground conduit exists and will be ganged with existing cables when place overhead; however, the long range impacts of possible future installation of junction boxes, relay equipment and back-up power supplies will require additional design review and has the potential to create significant visual and aesthetic impacts.

Fiber Optic Design and Construction (19716) - New Commercial Telecommunications - *continued*

- Comprehensive Plan: This projects furthers the objectives of the Environmental Resource Element to evaluate and update Palo Alto's policies and programs continually in light of changes in resource supplies and development of new technologies. To the extent that the fiber optics will be placed underground where underground now, the project furthers Program 12 of the Urban Design Element relating to continuing the City Program to place Utility lines underground. To the extent above ground equipment will be added in future installations, the project could be inconsistent with this Comprehensive Plan Program.
- Operating: Utilities Department-Electric Utility. Will require legal assistance, training, and additional consultant support.
- Telecommunications: Additional fibers reserved for City use will provide an opportunity for enhanced internal telecommunications.

MEMORANDUM

TO: Utilities Advisory Commission

FROM: Bernard M. Strojny
Assistant City Manager

AGENDA DATE: June 25, 1996

SUBJECT: Telecommunication Strategy Study -- Phase 4 Results and Recommendations

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REQUEST

This report presents the results of Phase 4 of the City's Telecommunication Strategy Study and requests that the UAC approve and recommend to the City Council staff's recommendation for the Electric Utility to develop a dark fiber ring around Palo Alto.

RECOMMENDATIONS:

This report recommends that the City:

1.) Implement a flexible positioning strategy by having the Electric Utility develop a dark fiber ring to be co-located in conduit and on poles with existing Utilities' communications lines,

2.) Finance the positioning strategy with Electric Utility reserves in an amount estimated to be $1,860,000 in FY 96-97 and $210,000 per year thereafter until costs are recovered out of future cash flows generated from the fiber ring[1],

3.) Create one new Full Time Equivalent staff position in the Electric Utility in FY 96-97 with general responsibility for the City's commercial telecommunications activities, and

4.) Convert Phase 5 of the Telecommunication Strategy Study from business plan development to strategy implementation.

The Telecommunication Advisory Panel (TAP), formed at the start of the project, reviewed the Phase 4 report and provided feedback to staff. Six of the seven TAP members attended a meeting to discuss the Phase 4 report and unanimously endorsed the recommended strategy.

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[1] All financial data for the recommended strategy are stated in 1996 dollars unless otherwise specified.

BACKGROUND:

On May 8, 1995, the City Council approved a Budget Amendment Ordinance to use $135,100 from the Electric Rate Stabilization Reserve to fund the five-phase study to develop a telecommunications strategy for the City. The selected consultant, The ICT Group, completed Phases 1-3 of the study at a cost of $91,000. As a part of Phase 3, staff also prepared a supplemental report to further examine a class of strategies described as "Leased Access" strategies. The results of Phases 1-3 were presented to the Utilities Advisory Commission on January 10, 1996 with a recommendation to have staff assume responsibility for Phase 4 of the study with limited technical assistance provided by one or more consultants. Following UAC endorsement of this recommendation, the City Council approved the recommendation at their February 26 meeting.

Following the issuance of a Request for Proposals, staff selected the Media Connections Group (MCG) to provide technical support for staff during Phase 4 of the study. Of the $33,000 originally budgeted in May 1995 for Phase 4, $15,000 were used for MCG's consultant services. MCG provided key insights and input data used by staff to model alternative strategies. MCG also critically reviewed staff's evaluation and Phase 4 report.

POLICY IMPLICATIONS:

The recommended strategy would be an extension of the City's long-standing policy of providing utilities infrastructure for the citizens and businesses of Palo Alto. Implementing the strategy would modify existing City policy by leveraging existing Electric Utility infrastructure to initiate the City's involvement in providing telecommunications infrastructure.

This involvement would initially be limited in nature, but could later be expanded if deemed appropriate. While the recommended strategy involves limited financial commitment, it has the potential to deliver substantial benefits to the Palo Alto community. The recommended strategy was identified as the City telecommunications strategy that best achieves the telecommunications objectives approved by the City Council on February 26, 1996 (as described below in the Discussion section).

Additionally, in response to the passage of the Telecommunications Act of 1996, staff is also developing policy guidelines for the use of the public rights of way for telecommunications infrastructure development. Staff will report back to the City Council after these guidelines have been drafted.

DISCUSSION:

The overall goal of the Telecommunications Strategy Study is to identify the best City strategy for accelerating the pace at which high-quality, low-cost, advanced telecommunications services are delivered throughout Palo Alto while limiting any negative impacts on Palo Alto's physical environment. The first three phases explored what the City is best positioned to do, estimated the size and nature of the Palo Alto telecommunications market, and narrowed the field of potential City telecommunications strategies down to the two most attractive strategies:

- *Lease Existing Infrastructure* - The City actively leases spare conduit and pole space to private telecommunications network developers and/or companies in Palo Alto interested in establishing point-to-point telecommunications links.

- *Develop a Network and Lease Access* - The City develops a new telecommunications network, independently or with one or more partners, and leases access to all interested services providers.

The Phase 4 evaluation process consisted of:

- An assessment of the City's strengths and weaknesses relative to competitors.

- Meetings with telecommunications managers from Palo Alto corporations, representatives from the Palo Alto Unified School District, and PA-COMNET.

- Issuance of a Request for Information to telecommunications service providers. Preliminary discussions with representatives from AT&T, Brooks Fiber Communications, Cable Co-op, ICG Access, Pacific Bell, SpectraNet International, and the Teleport Communications Group.

- Qualitative evaluation of a range of potential telecommunications strategy variations.

- Quantitative evaluation of specific telecommunications strategy implementations.

One major finding in Phase 4 was that the City has the ability to rapidly construct a fiber optic ring around Palo Alto, passing through residential areas and all major underground business districts, by co-locating fiber in conduit and on poles with existing Utilities' communications lines. Such a project could be completed at less than a third of the cost competitors would incur to bore underground and install new conduit. This is the City's most significant competitive advantage.

A second major finding was confirmation that telecommunications service providers and network developers are interested in working with the City to gain access to potential Palo Alto customers across a range of options, including leasing dark fiber installed by the Electric Utility. Leasing dark fiber from the Electric Utility would afford service providers and telecommunications network developers with a low cost opportunity to gain direct access to Palo Alto customers, while freeing up some of their scarce network development funds for opportunities in other cities.

While the City could later choose to develop additional network facilities, the construction of a fiber ring as the network backbone is a necessary first step in the development of all telecommunications networks considered. Such a ring could form the backbone of the independent networks of many telecommunications network developers or could form the

backbone of a single network developed exclusively by the City and a partner (if any). The City can defer this decision until after the fiber backbone is constructed.

If the City has the Electric Utility develop a fiber ring, it will best meet the telecommunications objectives approved by City Council by positioning the City to deliver the maximum community benefits with substantial earnings potential while limiting financial risk. The manner in which the recommended strategy achieves each of these telecommunications objectives is described below:

- ***Accelerated deployment of a broad range of advanced broadband telecommunications services to all of the citizens and businesses in Palo Alto.***

  Fiber optic infrastructure will be a necessary element of networks capable of delivering advanced, two-way broadband telecommunications services. The recommended strategy involves the Electric Utility deploying enough fibers to facilitate the cost-effective delivery of such services to all of the residents and businesses of Palo Alto.

- ***Decreased costs for both conventional and advanced telecommunications services (as compared to the costs for similar services if provided without City involvement).***

  By co-locating fiber with existing Utilities' communications lines, the Electric Utility has the ability to install a 15-mile fiber ring around Palo Alto that is roughly 70% underground -- without the need for expensive boring or trenching in underground districts. Given that the cost of directional boring and installing new conduit is estimated at $20/foot (over $100,000 per mile), this presents an opportunity for a corresponding savings to end users.

- ***High quality for both conventional and advanced telecommunications services.***

  Fiber optic cable is the most reliable and error-free telecommunications media available. When deployed in a route-diverse ring with signals sent both clockwise and counterclockwise around the ring, even a cut through the fiber cable (e.g., from a backhoe) will not interrupt the transmission of a signal sent between any two points on the ring. By installing fiber optic cable in a route-diverse ring, the City will ensure that a backbone is available that is capable of delivering the highest quality telecommunications service possible.

- ***Enhanced competition among telecommunications service providers and increased telecommunications choices for consumers (who are currently limited to monopoly service providers for telephone and cable television service).***

  By installing a fiber optic ring with a high fiber count, the City will have the ability to promote competition by leasing individual fibers to a number of service providers. By

reducing the barrier to entry associated with the cost of developing new infrastructure, more companies will be able to avoid a significant portion of those costs and economically provide competitive telecommunications services in Palo Alto. This will have the effect of increasing choices for consumers while minimizing disruption to the public rights of way.

- *Limited or no financial risk exposure to the City.*

  At an estimated construction cost of $1.5 million to be funded with Electric Utility reserves, risk exposure is limited to a manageable level. It is anticipated that lease revenues would recover the construction costs and the associated staffing and other costs within a 3-5 year period. Furthermore, in the unlikely event that the Electric Utility is unable to secure sufficient lease revenues, the fiber ring will be a valuable asset that could be sold at a price likely to exceed the construction cost due to the value added by the use of the Electric Utility's existing conduit.

By implementing the recommended strategy, the City would focus its telecommunications activities directly on its key competitive advantage: the Electric Utility's ability to rapidly construct a route-diverse fiber ring without incurring the high cost of boring underground and installing new conduit. By independently developing the ring, the Electric Utility will maintain exclusive control over its infrastructure and situate itself in a flexible position of strength from which to utilize the fiber to the greatest benefit of the Palo Alto community. At a construction cost estimated to be $1.5 million, but with a resale value believed to be considerably higher, the construction of a fiber ring would be a conservative step forward. However, although conservative, it would position the City to deliver tremendous benefits to the community while generating additional revenues for the Electric Utility.

ALTERNATIVES:

If the City's sole objective is to minimize financial risk to the exclusion of other stated objectives, it could instead lease existing infrastructure to a single telecommunications network developer. However, this would limit the Electric Utility's earnings potential and result in the Electric Utility relinquishing control of infrastructure to a private company interested in keeping competition out of Palo Alto. In so doing, the City would forego the opportunity to deliver the community benefits associated with a truly competitive telecommunications marketplace.

The City could also choose to pursue a more aggressive strategy involving additional network development. At this time, however, it is not necessary for the City to make such a decision. As such, it would be prudent for staff to continue to gather additional information and for the UAC and Council to defer consideration until after the fiber ring is developed. With the recommended strategy, the City would be positioned to lease dark fibers or to develop additional network facilities if later determined to be appropriate.

Attachments 1 and 2 thoroughly document the evaluation of alternative strategies.

FISCAL IMPACT:

Following Council approval of the Phase 4 recommendation, telecommunications project management will be assumed by the Utilities Department and telecommunications will be recognized as a major Electric Utility project. Two new Electric Utility FTE staff positions will be created over the next two fiscal years (one in FY 96-97 and one in FY 97-98) to implement the recommended strategy.

The recommended strategy will require an estimated $1.86 million to be taken from Electric Utility reserves to fund the construction of a dark fiber ring and other expenses during FY 96-97. All telecommunications asset expenditures will be tracked separately from other Electric Utility assets. After the first year, if the City limits its activities to leasing fiber strands in the dark fiber ring, ongoing costs are estimated to be $210,000. These annual costs are detailed in the table below.

Cost Item	FY 96-97 Costs	Annual Costs after FY 96-97
Fiber Cable Costs	$1,370,000	
Design and Installation Costs	$138,000	
Construction Oversight & Inspection	$110,000	
Outside Legal Counsel	$50,000	
New FTE Salaries	$80,000	$130,000
New FTE Benefits / Training	$29,000	$46,000
Maintenance Equipment	$75,000	$15,000
Leased Office and Equipment Space	$4,000	$4,000
Miscellaneous Costs		$15,000
Total Cost	$1,856,000	$210,000

The recommended strategy is expected to pay for itself over a 3-5 year period with mature net cash flows in excess of $1 million per year projected thereafter. (See Appendix D of Attachment 2 for financial model details.)

Of the $135,100 budgeted for consultants as a part of this study, $106,000 was spent on consultant assistance during Phases 1-4, leaving $29,100 available for consultant assistance during strategy implementation in Phase 5.

ENVIRONMENTAL ASSESSMENT:

This study is not a project for purposes of the California Environmental Quality Act; therefore, no environmental assessment is required.

STEPS FOLLOWING APPROVAL:

Following City Council approval of the recommended strategy, staff will proceed with implementing the strategy as Phase 5 of the Telecommunications Strategy Study. The Media Connections Group will provide additional consultant assistance as necessary during strategy implementation.

The Phase 5 implementation will involve construction of the fiber ring and additional discussions with telecommunications service providers and telecommunications managers from Palo Alto businesses. These discussions should provide information that will help staff determine the number of fibers to include in the fiber ring and evaluate additional network development opportunities.

Additionally, the City Attorney will retain outside legal counsel to address any legal issues associated with implementing the recommended strategy.

ATTACHMENTS:

1. City Staff. *City of Palo Alto Telecommunications Strategy Study: Phase 4 Report, Volume 1.* June 19, 1996.

2. City Staff. *City of Palo Alto Telecommunications Strategy Study: Phase 4 Report, Volume 2 - Appendices.* June 19, 1996.

Prepared by: Van Hiemke / Tom Habashi

Approved by:

Edward J. Mrizek
Director of Utilities

Approved by:

Bernard M. Stroiny
Assistant City Manager

ORDINANCE NO. _____

ORDINANCE OF THE COUNCIL OF THE CITY OF PALO ALTO AMENDING THE BUDGET FOR THE FISCAL YEAR 1996-97 TO CREATE AND FUND A TELECOMMUNICATIONS PROGRAM INCLUDING THE CREATION OF A CAPITAL IMPROVEMENT PROJECT, AND EXTENDING A LOAN FROM THE ELECTRIC FUND FOR THE PROGRAM

WHEREAS, pursuant to the provisions of Section 12 of Article III of the Charter of the City of Palo Alto, the Council on June 24, 1996 did adopt a budget for fiscal year 1996-97; and

WHEREAS, the Electric Utility has been involved in the development of a plan directed towards promoting the formation of a competitive market for commercial telecommunications activities in Palo Alto; and

WHEREAS, to participate in this market, a fiber optic ring is proposed to be developed around Palo Alto, which is co-located in conduits and on poles with existing communications lines; and

WHEREAS, to fund the creation of this fiber optic ring, a loan is proposed to be made from the Electric Rate Stabilization Reserve to the proposed telecommunications program; and

WHEREAS, the proposed telecommunications program will be a subfund of the Electric Fund but the assets of the program will not be included in the assets that are used for the calculation of the equity transfer from the Electric Fund to the General Fund; and

WHEREAS, the telecommunications program will require creation of a capital improvement project Fiber Optic Design and Construction (CIP 19716), funded in the amount of $1,995,400 and will also require operating budget expenses in the amount of $101,600; and

WHEREAS, some of the needed funds will be reallocated within the Electric Utility to the telecommunications program; and

WHEREAS, the Electric Utility has already invested $194,000 in the development of the telecommunications program, which will be repaid as the program begins to generate revenues; and

WHEREAS, additional appropriations are needed to fund the project; and

WHEREAS, City Council authorization is required to amend the 1996-97 budget as hereinafter set forth.

NOW, THEREFORE, the Council of the City of Palo Alto does ORDAIN as follows:

SECTION 1. Capital Improvement Project (CIP) 19716, "Fiber Optic Design and Construction" is hereby created.

SECTION 2. The sum of One Million Nine Hundred Ninety Five Thousand and Four Hundred Dollars ($1,995,400) is hereby appropriated to Capital Improvement Project (CIP) 19716, "Fiber Optic Design and Construction." This appropriation shall be funded as follows:

a. The sum of One Million Nine Hundred Eighty Six Thousand and Six Hundred Dollars ($1,986,600) is hereby transferred from the Electric Rate Stabilization Reserve to the appropriation for CIP 19716; and

b. The sum of Eight Thousand Eight Hundred Dollars ($8,800) is hereby reallocated within the Electric Fund to CIP 19716.

SECTION 3. The sum of One Hundred One Thousand and Six Hundred Dollars ($101,600) is hereby appropriated to the functional area Commercial Telecommunications in the Telecommunications Program. This appropriation includes a $17,600 appropriation to salaries, a $75,000 appropriation to non-salaries, and a $9,000 appropriation to allocated charges. This appropriation shall be funded as follows:

a. The sum of Seventy Five Thousand Dollars($75,000) is hereby transferred from the Electric Rate Stabilization Reserve to the appropriation for the functional area Commercial Telecommunications; and

b. The sum of Twenty Six Thousand Six Hundred Dollars ($26,600) is hereby reallocated within the Electric Fund to the functional area Commercial Telecommunications.

SECTION 4. The transactions described in section 2 and 3 will reduce the Electric Rate Stabilization Reserve from $16,943,200 to $14,881,600.

SECTION 5. The sum of Two Million Two Hundred Ninety One Thousand Dollars ($2,291,000) is hereby reserved in the retained earnings of the Electric Fund for the Telecommunications Program.

SECTION 6. As specified in Section 2.28.080(a) of the Palo Alto Municipal Code, a two-thirds vote of the City Council is required to adopt this ordinance.

SECTION 7. The Council finds that the appropriation of funds does not constitute a project under the California Environmental Quality Act. Environmental review for the Capital Improvement Project has not been completed at this time. This Council action makes expenditure of funds expressly contingent upon completion of an environmental review.

SECTION 8. As provided in Section 2.04.350 of the Palo Alto Municipal Code, this ordinance shall become effective upon adoption.

INTRODUCED AND PASSED:

AYES:

NOES:

ABSTENTIONS:

ABSENT:

ATTEST:

_____
City Clerk

APPROVED:

_____
Mayor

APPROVED AS TO FORM:

_____
Senior Asst. City Attorney

_____
City Manager

_____
Deputy City Manager, Administrative Services Department

_____
Director of Utilities

City of Palo Alto

Utilities Advisory Commission

EXCERPT FROM DRAFT MINUTES OF THE UTILITIES ADVISORY COMMISSION MEETING OF JULY 25, 1996

Item 6.d. Telecommunications Phase 4 Report

Commissioner Chandler: I have been advised by the city attorney that I have a conflict of interest on this item, so I will not be participating.

Chairman Johnston: I will now turn over this item to Bernie Strojny.

Mr. Strojny: Thank you, Chairman Johnston and members of the Utilities Advisory Commission. The last time we were here was January of this year. We were talking about the conclusion of Phase 3 of the telecommunications strategy study. At that time, we came to the UAC with a recommendation to focus on two main strategies. Those strategies were the possibility of leasing the existing infrastructure that the city has in place, making good use of that, and the second strategy was to look at developing a network and leasing access to it. Those were the recommendations which came to the UAC and which you approved last January. Those recommendations were taken to the City Council in February and the council approved those recommendations of Phase 3. The staff then marched into Phase 4. We are here tonight to present the Phase 4 report to you and to share with you the findings we have gathered from the Phase 4 report. Joining me tonight are Van Hiemke, the resource planner in the utilities department, and Dave Rozzelle, a principal with the Media Connections Group. Van, of course, has done the lion's share of the work on this report. Dave has assisted him as a consultant. That has been instrumental in helping us to move this issue along. Without further ado, I would like to present an overview of the Phase 4 evaluation process. In Phase 4, what we were doing was assessing the city's strengths and weaknesses relative to the competition that we would face in the area of telecommunications. As a part of that process, we met with the telecommunications managers of four of the largest Palo Alto corporations, as well as representatives from PAUSD and PA-COMNET, the city's electronic community group, and one

with which we keep in close contact. In addition, we also issued a request for information and had some discussions with potential telecommunications service providers. Thus far, we have indicated in the report that we have received some positive response from those that we have talked with. We also conducted a qualitative evaluation of the range of potential telecommunications strategy variations. From that, we also looked at and targeted a quantitative evaluation of the specific strategy implementations that we would be looking at. Two weeks ago, we also met with the Telecommunications Advisory Panel to review this report and the recommended strategy. That group consists of two council members, as well as Chairman Johnston and members of the community at large who are involved in telecommunications. That is an overview of what the Phase 4 evaluation process was all about.

When we engaged with Phase 4, we were following the objectives stated in the Phase 3 report. I want to run through those for a few minutes to focus on what really guides this recommendation that we have before you this evening. The first area is the accelerated deployment to all Palo Alto businesses and residences. We feel that this is an essential objective on which we have to focus as part of any recommended strategy. We also feel that the recommended strategy has to result in decreased cost for end users. We think the city's involvement in telecommunications can definitely play a role in that. We feel that the services to be provided must be high quality. They must be reliable and error-free when talking about telecommunications. The data and information transferred over telecommunications are extremely critical to our businesses and residents who rely upon them. It is very important that as one of the objectives, we are enhancing competition in the city and increasing consumer choices. We all know that the Telecommunications Act of 1996 was passed by Congress recently and was signed by the President. That legislation definitely has inherent in it the move toward increased competition in the telecommunications industry throughout the country. We feel that this objective is very consistent with that. Lastly, there is limited or no financial risk exposure to the city. The key there, of course, is a proper balance between the risk involved and the reward to be received from the activity. That summarizes the objectives that we followed and adhered to as we went through the Phase 4 process as we indicated that we would in Phase 3. What I would like to do now is to focus on the strengths and weaknesses that we looked at in examining the city's possible role in telecommunications. Rather than going though them one by one, we have laid out both in the report and in the transparency tonight the physical assets and core competencies that the city has in strengths. There is no doubt that the city's experience in utilities and the involvement that we have had and the expertise that we have developed can really assist us in moving into the telecommunications area as an adjunct to the things we have done. It will enhance the use of the facilities that

we have in the city presently.

The main strength that jumps out at you, without doubt, is the fact that the city does own a considerable amount of conduit that has space available for the installation of fiber optic cable. It is a precious asset that we have, and one that we feel the city should take strong advantage of. We have indicated at the the bottom of the page that just the cost of boring and installing new conduit would be $100,000 per mile, not including the cost of the fiber itself. There is a definite difference in the city's ability to install fiber in existing conduit on existing poles vis-à-vis having to install from scratch. This is what many service providers would have to do.

We have also identified weaknesses. This is a telecommunications business and the city has not been involved in this before. We acknowledge that. We also know that we can overcome some of those weaknesses by partnering, as others have, in telecommunications and partnering some of the kinds of experience that would help us to move ahead in that business. We also feel that the utility itself is entering into a very different era in terms of deregulation and competition and that the challenges faced by the utility as a whole fit in quite well with the kinds of challenges inherent in the telecommunications business. So although they may be viewed as weaknesses now, I feel there are strengths developing out of this. Those are the strengths and weaknesses that we wanted to lay out broadly for you. We have identified them in the report, so rather than going over them at this late hour, one by one, the key is the conduit and poles.

What I would like to do now is to move on to how this fiber ring would look and act in the City of Palo Alto. What we have done here is to show how such a ring could be constructed, which would co-locate with the existing conduit we have in place for the city's utility communication system. As you can see on the map, the ring would run through all of the business districts in the city, most or all of which are underground. They would then be connected through business districts and other areas of town, with the potential to be extended into the residential districts from virtually any point on the ring. The ring itself would provide us with redundancy, which is very important in the installation of fiber optic cable. It would allow us to develop a backbone ring that would provide us with very high reliability and very good coverage for the city, in our opinion. So that is what we have in mind. It would be 15 miles in length. In the case of the undergrounding itself, about 70% of the system would be underground and 30% would be located on poles.

The development of a fiber optic ring is very attractive to the city and to the utility for some very specific reasons. We have highlighted those reasons here. It very clearly best meets the objectives that we have identified earlier, approved by the City Council and the full range of objectives that were laid out. It focuses directly on the city's key competitive advantage, which are the assets that we have now that can be employed in this capacity, as I pointed out earlier. It situates the electric utility in a flexible position of strength. This is an opportunity for the utility to diversify its operations into another area which we think can yield important bottom line revenues to the utility and assist in diversifying its operations. We feel that although there is some investment involved, it is a limited investment, one that is well founded and well supported. It requires just a limited investment and some new expertise, but that expertise, quite frankly, is not the full range of expertise that would be expected of a telecommunications business in the usual sense of the word. The city is not going to become a service provider. We are going to be installing and operating a fiber optic ring, and we will be working with and negotiating contracts with service providers to have them use the ring in a productive manner.

The ring itself can be implemented rapidly, since we do have the assets we have. We will be able to pull fiber optic cable through the conduit in a relatively brief amount of time and be able to have the ring installed in the very near future. The ring itself will be highly reliable, and future proof infrastructure fiber optic cable is the infrastructure being used for the kind of telecommunications we are talking about that would provide adequate bandwidth for a long time to come, in our opinion. We feel that the installation of that type of fiber at this point is exactly where the city needs to be in providing those kinds of services to our community. The system would be capable of supporting multiple network developers as service providers with significant growth potential. The ring that we are talking about has a significant amount of fiber that would be installed initially, and it would provide the opportunity for multiple developers to come in and utilize that infrastructure. We have looked at the economics of that for network developers and service providers. Quite frankly, there is a range where it is very attractive to those developers to use the city's fiber optic ring. Once you would get to an area of a significant amount of fibers being used, it may become more economical or feasible for some service providers to install the fiber themselves. We have done a pretty careful analysis of that and feel pretty comfortable that the amount of fiber we are providing would really attract a number of network developers and service providers. Lastly, there is the potential for significant internal benefits for the utilities and other city departments. The city's needs are growing in terms of communications. We have seen the development of major systems in the

city which require higher bandwidth. We have seen the development and use of the internet, moves toward the intranet, and all of those kinds of demands on the city's communications system will be accommodated much more easily through a fiber optic-based approach.

So those are the reasons why we feel the fiber optic ring is attractive and makes sense for the city at this time. At this point, we would also like to take a look at why we think it makes an awful lot of sense from the standpoint of the kind of system we are suggesting. On this chart, you have the ability to see the number of fibers leased on the left, running from zero up to the maximum number that would be installed, 240, and on the X-axis, you can see the average lease rate per fiber mile per year. The lease rate we have identified is based upon information we have received from agencies presently leasing dark fiber, and the $1,000 to $1,500 per fiber mile per year is a pretty accurate estimate as to how much that would cost. To give you an idea as to what it means with respect to the break-even points, with a three-year break-even point, it would mean that the city would be leasing 95 fibers at $900 per fiber mile per year. That obviously is well short of the number of fibers that would be installed in the system at a rate that is presently below the market rate for leasing fiber. For a ten-year break-even line, we are talking about 60 fibers at about $550 per fiber mile per year, which is way below the market and leasing even fewer number of fibers. So there is great ability for us to lease the number of fibers that we are talking about and be able to charge a very competitive rate for those fibers. We feel that we would not only be able to break even but we can produce a significant return to the utility. Are there any questions?

Commissioner Sahagian: I have a question which is the same question I had when I reviewed Appendix D in your Volume II. In your analysis of your break-even and the revenues that it would take for the break-even point, you have indicated that there is a pretty good opportunity to approach markets that would otherwise be transmitting over telecommunications lines and going to network and service providers. Have you actually discussed it with specific network and service providers? Looking at it terms of fiber miles per year, it is hard for me to really get a handle on what it means to get to that break-even point. Have you looked at it in terms of what kind of a customer base would have to be established, and how large it would have to be to actually achieve that kind of break-even point?

Mr. Strojny: Yes, we have. We have had discussions with the service providers themselves regarding what kind of fiber capacity they would like to see. We feel that the approach and the break-even points that we are looking at here fit in very closely with what their own plans might be. That will be further developed as we continue discussions with them. We have also taken a look at how many service providers it

would take to make a system like this be successful. By and large, it takes three or more service providers who would be leasing in the range of 20 to 30 fibers each to make a system like this viable and successful, providing them with the incentives they would need to want to use this system at the rates we are suggesting, as opposed to building it themselves and having to incur that capital cost up front. So we have done an analysis of that and we have additional data to support that. I will turn this over to Van at this point who will amplify on that.

Mr. Hiemke: It really becomes an issue of supply and demand. What is shown in this slide is that at different rates, how many fibers would the city need to lease to break even. So it is a line for breaking, as opposed to a single point. For a given lease rate, we can identify the number of fibers that would need to be leased. It could either be a single lease or it could be a number of smaller leases. In terms of the analyses we have done, we have identified that the most value will be delivered to a service provider or network developer that wants a small number of fibers. Naturally, it is the first fiber that is the expensive one. They have to bore underground for installing that first fiber. As they get out to the area of 100 fibers, the cost of the conduit on a dollar per fiber mile basis is much smaller. Our advantage is significantly less in that case, so what we find, in general, is that fiber leases on the order of 50 fibers or less are what we are looking at as being the likely amount leased. That is dependent upon the final lease rates being determined. That in no way should indicate what we feel the final lease rate would be. That is going to be an issue for further discussion down the road.

Commissioner Sahagian: How many fibers would be contained in this trunk line?

Mr. Hiemke: 240 fibers are what were modeled in the analysis. In our discussions with service providers, we have not carried it out to the level of detail to identify exactly how many fibers they are looking for. As we move forward, we would expect to do that and get a better picture of how many they are looking for, and possibly adjust the 240 fiber number. That is what we have in there for now, and we have reasons for thinking that would be a good number.

Mr. Strojny: The next slide addresses one of the initial strategies that we talked about in Phase 3. That is the strategy of leasing the existing infrastructure that we have. Although it would involve less of a financial risk to the city, staff does not recommend that strategy for the following reasons. We feel that the city would relinquish control of infrastructure to a private company interested in keeping competition out of Palo Alto. To some extent, it would provide a monopoly

opportunity for someone to use that conduit and control that conduit for their own purposes. We also feel that the electric utility would no longer have exclusive access to its communications conduits. These are existing conduits with communications lines in them, as mentioned earlier, either coaxial or twisted pair, and it is important that the city maintain control over those conduits and what is contained within them. So that is a very important consideration. The city would forego the opportunity to deliver the community benefits associated with a truly competitive telecommunications marketplace, because to the extent that a monopolistic type situation exists, the competitive objective that we have in entering this phase of the study would be lost. I think the community would suffer as a whole. The value added by the competition that we would see coming from the recommendation that we have before you tonight would suffer to a great extent. So we think that the opportunity to deliver the community benefit is the most enhanced by the recommended strategy. Lastly, if the electric utility develops a fiber optic ring instead of leasing existing infrastructure, the upside potential is there without a substantial increase in financial risk. There is financial risk involved in the recommended strategy, however, the outside potential is definitely there. As we have looked at the pricing mechanisms and after having initial discussions with the service providers, we think there is a considerable upside possible. We would like to seize that opportunity as a part of moving into telecommunications. So for those reasons, we are not recommending the strategy of leasing existing infrastructure.

Also at this point, we would like to indicate that one of the other strategies we looked at would have taken the city further into the area of network development than we are recommending at this time. We are saying not to go that far with network development for the following reasons. The electric utility and/or the city would unnecessarily incur additional risk. We realize that this is a new opportunity for the city in an area where we have not been involved before, and we do not think it is prudent to accept more financial risk than is necessary at this stage. Here are a couple of examples that show that in order for us to expand the system and have a competitive access provider network for larger businesses, we are talking about an additional $2.1 million in order to accomplish that. If we were to take a look at full hybrid fiber coax network, we are looking at $11 million in order for a system like that to be installed, for the city to be involved in both the fiber side as well as the coax installation. That would be for residents and smaller businesses as well as larger businesses.

The recommended development of the fiber optic ring is really a flexible positioning strategy that would enable the city to develop additional network facilities, if later determined to be appropriate. That is really the importance of this recommendation. It positions the city to

be able to do other things downstream if we wish to. It gets us into telecommunications. It enhances competition, and it really attracts service providers to come in here, but our options are open downstream. If the city wishes to extend that system, we have the ability to do so.

At the last bullet, we are indicating that those kinds of network development decisions really can and should be deferred if they are to be considered at some subsequent time. We think that at this point, going as far as we are suggesting is really where the city should be, and not go any further.

What we would like to do next is to discuss with you what is going on in some other cities, especially in California. We have discussed this with you before, and some of the things that have happened since we were last before you. The first one is the City of Alameda. They have moved ahead and are pulling five miles of dark fiber through existing conduit to form a series of three fiber rings. The installation is now scheduled for completion by the end of July. They are in the throes of entering into an agreement with ICG Access, a network developer. They would be getting involved in a lease covering less than 10% of the fiber that they would be installing. They would be able to recover the cost within a six-year period. So Alameda has come from nowhere in this area and is moving very quickly into the area of fiber optics installation. Their primary motivation is revenue. They are not installing it, as we understand it, to enhance the existing communications of their electric utility as some of the other cities are, but see it as a real business opportunity. Anaheim, one of the cities we talked about before, is now in the final throes of installing a 50-mile ring around the City of Anaheim. That has been done to connect their substations that are a part of their electric utility. It will also be used to link city facilities into the substation system. That should be operational by the end of July. At the present time, they are also involved in negotiating with SpectraNet to have the surplus fibers from that system be used as the backbone of a network that would be developed for Anaheim's businesses and residences. They hope to have a final agreement with SpectraNet by September of this year. They have been working on this for some time. Burbank is right now installing a 20-mile fiber backbone, initially for their electric utility and city needs, but they are installing additional bandwidth which they anticipate using to service their businesses in Burbank, especially the large businesses in the entertainment industry.

Other cities are Colton in San Bernardino County that has installed a five-mile fiber optic ring for their electric utility and substation system. It will be operational within a month. They are also installing an additional five-mile fiber extension that will be used to

interconnect city facilities in the system. They also are installing surplus fibers in anticipation of providing services to other members of the community. Los Angeles Water & Power has been involved in installing fiber for their internal needs since 1989. They have over 120 miles of fiber rings in place, with plans to expand to 240 miles. They have been aggressively leasing dark fiber for the last year-and-a-half. They currently have nine lease agreements with five companies for approximately 1,400 fiber miles at lease rates ranging from $900 to $1,440 per fiber mile per year. Lastly, Santa Clara, one of our neighboring cities, is at this point designing a 30-mile fiber optic backbone to meet their electric utility communications needs, as well as other needs involved with their city government. They also are reserving surplus fiber in anticipation of enterprise development of that capability. They are expected to begin construction in November of this year. That gives you a flavor of what is happening in other cities in the state. Obviously, there are other cities throughout the country who are also involved in similar initiatives. A lot has been happening, especially during the last six months, and we anticipate that the trend will continue.

We would now like to bring this discussion to a summary of the major findings that we have identified as part of Phase 4. The electric utility does have a significant opportunity to rapidly construct a route-diverse fiber optic ring around Palo Alto at a much lower price than others by locating fiber within existing utility communications lines. Telecommunications service providers and network developers are interested in working with the city to gain access to potential Palo Alto customers across a wide range of options, including leasing dark fiber installed by the electric utility. As we have indicated in the report, we have heard from six service providers thus far. They have all been quite interested in working with the city in any kind of system that we would design and install. We feel that quite frankly, if the city does move forward with this initiative, we would expect to hear from other service providers who have not, as yet, contacted us in order to explore some interest with us.

The construction costs are estimated to be about $1.5 million, with a resale value that is considerably higher than that. The construction of a fiber optic ring would be a conservative step forward. As we have indicated in the report, the value of this ring, once installed, would be considerably more than we would spend for it. It would be a valuable asset that, if the city did not wish for some reason to pursue it as we have envisioned, could be sold. Frankly, it would yield a pretty significant return on investment. We are also saying that although the strategy is conservative, we would definitely position the city to deliver tremendous benefits to the community while improving the financial strength of the electric utility through diversification and

to a new and growing market with the potential for substantial return on investment. So those are the major findings that we have identified in Phase 4.

The recommendations contained in the staff report are an implementable, flexible positioning strategy by having the electric utility develop a fiber ring to be located in conduit and poles of existing utilities' communications lines to be financed by the electric utility reserves in the amount of $1,860,000 in fiscal year 1996-97, and then $210,000 per year thereafter. That would remain until costs are recovered out of future cash flows generated from the fiber ring itself. Also, that we create one new full-time equivalent staff position in the electric utility in FY 1996-97 with general responsibility for telecommunications activities and the actual construction of the fiber ring itself, as well as the negotiations and discussions with service providers that would be entailed, once the ring is installed, and even before that. Also that we convert Phase 5 of the strategy study from a business plan development to strategy implementation, and begin to move this effort forward in an attempt to have a system installed in the very near future. Those are the recommendations that we are presenting to the UAC this evening.

Chairman Johnston: Next we will go to members of the public.

Richard Gruen, P.O. Box 2351, Palo Alto: About a year ago, when you first proposed having $135,000 for a consultant study, the plan that you had to go with it looked so silly that I was unalterably opposed to it. I suggested to the City Council that instead, they put the money into hiring people with some expertise who would be able to understand what you could do that would be good for the city. You have done that. You have Van on board. The plan you have looks much better, and you have altered my unalterable opinion so that this is a plan that I can eagerly support, and in fact, suggest that you do a little bit more. So first, let me say thank you for putting some expertise into this, thank you for training Bernie so that he understands it, as well, and we now have something we can work with. That is the first comment.

The second comment is from my background as a purchaser of telecommunications services on behalf of both Intel and Advanced Micro Devices. I would mention that more than ten years ago, we installed fiber optics at Advanced Micro Devices, so that is part of where I am coming from. One of the things that was very important to us was redundancy. I would say that that is still important to the folks involved. That is why you have a ring, and in fact, what I going to suggest is that you have yet more redundancy by using a few more interconnections. If you look at Middlefield Road, Middlefield shows on the map that there is already an underground district there, so

presumably, you have conduit that you could pull in. I would advocate the additional three miles being Middlefield, where you have an underground district, El Camino, where you already have underground, and the Embarcadero/Churchill route which you show on the existing coax route, that those three additional areas of about three more miles of fiber would add additional redundancy which I look at as backhoe prevention. I am mindful of the single backhoe that was able to take out all of the Internet service through MAE-West for more than a business day. It was stupidity, but just think of all of the folks who were not able to get their work done that day because of it. These additional pieces of redundancy, as well as additional access for additional businesses, would provide a great plus for the system you are talking about.

A third comment I would make (and you are going to hear this over and over again) is to put in more fiber. I made my folks do that also at AMD. We had an elaborate study about possible future use. We came up with some amount of fiber, and I said arbitrarily, we are going to double it. Within two years, we managed to use up the doubled amount. So whatever you think you will be doing, you find that you need more. The number of fibers is such a small part of the cost, once you are going to pull a cable in, pulling the cable is the important part, not how many more of these little things you have in there. So you have that comment free of charge.

The other piece of arithmetic I would call to your attention is that you are talking about something on the order of $2 million to implement the ring even with that additional three miles I am talking about, and something, from your slide, of about $11 million to implement the residential program, or a total of $13 million. I probably would not advocate taking on $36 million in debt in order to avoid having a $13 million project. Where do you get that $36 million? That is the Cable Co-op number. Cable Co-op bought an older technology. It is kind of an axiom in Silicon Valley that older technologies cost more money. I don't know that we have to go back and pay the cost of an older technology in order to get the sort of thing that we need. Think of what people would pay for a 286 computer now compared to what they paid for it ten years ago. You wouldn't pay $5,000 for it. You might $100 for it. So there is something to be said for getting some new advantage for buying newer technology. Thank you.

Tom Passell, 3825 Louis Road, Palo Alto: I have lived at this address in Palo Alto since 1956. I served as the chairman of the committee on this subject of cable TV from 1970 to 1973. Since then, I served 13 years on the Cable Co-op Board of Directors and am currently on it, again having been off the board for one year. I am speaking as an individual tonight, not on an official board position on Cable Co-op.

I do applaud the conclusions of your study, and as a first step in the telecommunications business, it is an admirable and conservative way to start. I would, however, encourage you to keep the door open to extending this system to all of the citizens of Palo Alto, not just the businesses, using the coax system that Cable Co-op has in place. Additionally, consider extending it to adjacent communities which we also serve. It is my impression that your loop does leave this option open. It will be negotiated, and I don't believe it involves personally taking over our $36 million debt carte blanche in order to accomplish that purpose, contrary to our previous speaker's comments. In any case, I would like to say that even with a fiber backbone or a fiber loop, the final half mile to the customer is still a very viable thing, a very viable technology, a modern technology to the individual household. In other words, it is not old technology to do that final jump to the household from this fiber backbone or trunk or loop. I have a 100-foot piece of 10 mil fiber that I use for demonstrations to school children to show that you can get light from one end to the other, and they can flash a flashlight at one end and see the light at the other. You can really believe that fiber optics does communicate. Thank you.

Bob Moss, 4010 Orme, Palo Alto: I a member of both PA Comnet and a member of the Cable Co-op Board of Directors. I am speaking as an individual tonight. First, I would strongly endorse the staff recommendation for proceeding. It is an excellent one, and the background material adequately describes the advantages and the relatively low level of risk. I would like to expand a little bit on some of the advantages of a fiber backbone loop such as this which is not explicitly stated in the staff report. One of them is that once the system is up and operating, you will see a significant increase in people who are telecommuting and not driving to work. That will be especially true if the system is expanded beyond Palo Alto proper into Menlo Park and parts of East Palo Alto and Atherton. The staff report does allude to the number of people who are working at home and telecommuting right now. My experience and the experience of my friends is that that will only increase. As you all know, one of the biggest hot buttons in Palo Alto for the last 25 years has been traffic. Here is an opportunity to do something about it and conserve resources.

Secondly, you will find a significant increase in providing a sense of community. I am also a member of the Barron Park Association and we have, as you know, BPA Net which we have had up and running for about two years now. The advantages are significant. We communicate with each other rapidly in real time. I could go on for quite awhile giving examples of things we have discussed over the net, such as crimes in progress, problems in the community, answering questions. I had a request last night from a guy who wants to post a notice about his nanny to see if he can get a job for her since he is moving out of the

community. It is a marvelous way of building community and building a sense of belonging, which is all too often missed nowadays.

Another thing is that Cable Co-op's infrastructure, especially the coax, which passes every home in the entire area, is a very valuable asset. I can tell you from personal experience that coax works extremely well for high bandwidth communication. The problem is with the overall Internet network where you sometimes get held up. Com 21 has been testing on the coax system Cable Co-op's system in Cable Co-op's environment models that have 30 meg capacity downstream and 10 meg upstream on an experimental basis. We have, in fact, had high bandwidth experimental evaluations running on the Cable Co-op system for almost three years now. It is a completely two-way system and works just fine. The fiber, however, will provide redundancy and improve security and also significantly improve capacity, particularly for multiple users. So it has a lot of benefits.

Finally, one thing that was not explicitly stated in the staff report is that having a system like this would be a significant competitive benefit for Palo Alto. You have probably already seen speculation that people like Citibank would move into Palo Alto because of the accessibility and the access. Imagine what would happen if we had unparalleled broadband high reliability communications along with our existing unparalleled, high quality and reliable utility system. We could bring people in who wanted to set up, for example, sales offices and telecommute to people all over the world and not significantly impact our infrastructure, a real benefit to the community. So there are a lot of advantages to doing this. I have only scratched the surface. I have a study I did that goes on for four pages with a nine-page appendix giving examples of broadband communications advantages to the community and to the citizens.

The last point I would like to make is on the advantages of expanding beyond the city limits of Palo Alto, even though the cost would be higher to go outside than within. First of all, as the staff report notes, you would have significant economies of scale. Secondly, you could tie in other communities which really need support. You may not be aware of it, but the City of Palo Alto is already giving extensive support to East Palo Alto. We are providing over $300,000 a year in services in order to help out our neighbors. This will be another way of helping out our neighbors and building community throughout the region. By partnering with an organization such as Cable Co-op, you could have them provide the electronics, the service, the maintenance and the operation of the system and get the city out of the loop and have somebody do the job who has already demonstrated the capability of operating a broadband communications system successfully for a number of years. Thank you.

Margaret Cooley, 1330 Harker Street, Palo Alto: I am a Palo Alto resident, business owner and member of PA Comnet. I, of course, support the staff recommendations, and want to mention that PA Comnet does, as well, support the recommendations. I felt more moved tonight as a business owner and an Internet-related company right here in downtown Palo Alto. I want to mention a couple of points that you may or may not be aware of. A couple of things that we have going for us as a community going into this is that Palo Alto happens to have more Internet-related businesses than any other city in the United States, at least a few months ago, it did. Knowing how fast this industry changes, I cannot speak to today. I can certainly say that as a business owner, you can sign us up for two. We will take two. We are already very well known within our industry because of the reputation of BARRNet, now BBN Planet, and that is why we chose Palo Alto as the location for our company. It was not just so that we could walk to work. I have also read recently that Palo Alto is now known as the address to have in our particular industry, As the marketing person in our company, we are going to remain here for that reason. We get worldwide business because of our address here in Palo Alto. That can only bring further notoriety to us to go ahead with this. It is going to give us incredible PR worldwide. Just a quick story in that regard. I am one of the contact people for our on-line PA Comnet group. I received mail last week from somebody at AT&T in New Jersey who is from Sweden. He has been following on-line our story. He is so excited that a city in the United States would consider such a thing. His question to me was, do you think your fellow citizens will think you are Communists if you go ahead with this? He is all for it, and I see that as a positive thing. I hope that was not a negative point to my story. I really support this, and I hope you are going to go forward. It is a great thing for our community.

Chairman Johnston: That concludes the public comment. Can we proceed with comments?

Commissioner Eyerly: I liked your report, Bernie, and am all in favor of your recommendations. One comment is that I am very glad to see that this will lodge in the electric utility, which we were unclear about the last time. You mentioned as a weakness that there is no profit motive. I find on Page 30, Item 6 that the City Council has set a policy not to maximize returns to the city's General Fund. I take it that what they mean is to have it pay its own way but not try to make a lot of money. They certainly are thinking about having this make a profit as time goes along, if feasible. Is that correct?

Mr. Strojny: That is correct. There were some statements made at the last council meeting in terms of maximizing the return from the enterprise. That is what we were referring to in that part of the

report.

Commissioner Grimsrud: I think it is a great report, probably one of the best I have ever seen. You have done a very thorough analysis; you have presented the assumptions done uncertainty calculations, and provided all of the data. It is fantastic. You and your staff are to be complimented on that. I have a couple of questions. On Page 28, there is a question regarding Cable Co-op. Bob Moss made a comment tonight which is somewhat in conflict with this sentence here, "Cable Co-op's infrastructure must be updated to improve reliability and provide adequate capacity for the provision of high speed data service to more than just a limited number of customers." It looks like there is a bottleneck in their system. Where is that bottleneck? Is it between the customer and some other point, or is further down in the system? He seems to feel that coax has plenty of bandwidth between the customer and the fiber. I wondered if that is true.

Mr. Hiemke: I would say that it is true. Where the bottleneck occurs is when a number of customers' traffic is aggregated and sent back to the Cable Co-op head end over a single channel. You are trying to have a thousand customers share a single channel, whereas if you have fiber extending individual signals out to HFC nodes, or actually, the number of one thousand is probably a bad example, because what we have now is a situation where there are five trunk lines that run through Palo Alto, and say roughly three are devoted to Palo Alto, and the other two extend beyond the community. So those three trunk lines would share the traffic of all 13,000 customers. With what is viewed as a possible upgrade strategy, five hundred homes could be served by a single HFC node. This is similar to what Pacific Bell has proposed for San Jose. In that case, you would have 500 homes that would share the bandwidth, as opposed to 13,000. That is where your savings would come in with an upgrade.

Commissioner Grimsrud: My only other comment is with regard to funding the project and then the long-term issue of where this business entity is going to reside. Is it going to be a subsidiary of the electric utility, or is it going to be its own utility? I strongly feel that it ought to be, at least from a financial standpoint, and that it be clearly delineated what the costs are and what the paybacks are. We are talking about adding a staff person in the electric utility or in resource planning to support this area, and that needs to be clearly delineated. I wondered if that goes along with your philosophy on that.

Mr. Strojny: That is exactly what our philosophy is. Although it will be a part of the electric utility and not be separated out in some other way between funds, it will be separately tracked. All expenditures and revenues and all of the assets will be separately tracked apart from the

utilities' assets. That is how this program activity will function until a decision is made to treat it in some other way. We have had numerous discussions with Ed Mrizek on this, and he feels very strongly that that is the way he wants to birth this operation within the electric utility. To us, it makes the most sense to do it that way. Originally, we had talked about some type of a loan that would be involved, perhaps even be involved in the General Fund. Rather than do that, we decided it should be an internal activity within the utility. As long as it is tracked appropriately, we should have no trouble making sure that it is doing what we expected it to do, or finding out that it is not doing what we expected it to do, and be able to prune it.

Commissioner Sahagian: A lot of my comments have already been made. First of all, I too feel it was an excellent study, and I particularly like the way you organized your Executive Summary. It was very clear and concise. I think this whole project is very exciting, and I am in support of it. The questions I have are in two areas. You have selected a 240 fiber base case that you are recommending. I believe that if this is as successful in getting subscribers so that before long, you will be depleting the capacity and looking at expanding it, I wondered what is the incremental cost tradeoff of expanding it at the onset versus going back and retrofitting with more capacity later on. What is additional cost now versus having to remobilize later on to expand?

Mr. Strojny: In terms of the conduit that is there now and the space that exists, our recommendation is to optimize the use of that space and pull as much fiber as we can, given the physical constraints within the conduit. One of the things we looked at originally was to pull a smaller cable through, trying to be even more conservative, but the problem with that is that you essentially get one pull through the conduit. Once you pull the fiber cable that we are talking about, you will not have the opportunity to pull another one. There is not enough space to accommodate that. So our recommendation is to put just as much fiber as we can in that physical space. That is why the figure of 240 is just about what we think the capacity is of the space available.

Mr. Hiemke: And we have it almost full with 240. We could go to 288, as it turns out. 240 was selected, after sizing out one cable for the business market and one cable for the residential and small business market. 288 is the maximum. The cost of adding those 48 fibers would be roughly 48 times $5,500 per fiber is what the number is. So whatever that works out to be would be the upper end on the cost of expanding it. If we wanted to go beyond 288 fibers, then we enter into a situation where we would need to find other pathways through conduit, which may exist, but they are not easy to locate. We would have to do a further inventory of whatever conduit space we have.

Commissioner Sahagian: Another question really deals more with the business aspects. What is the payback? I am fully in support of trying to keep the revenues and costs compartmentalized and dealt with as a very clear and separate business entity. That is extremely important. For the parties that you indicate that are interested in subscribing, is there any possibility of getting any letters of intent or up-front memorandums of understanding or commitment at the onset? We do projects like this all the time for which we get advance commitments. I was curious as to whether that is an alternative.

Mr. Strojny: We have had some initial discussions, but quite frankly, in some cases, it is a matter of how this process moves, as well. If the service providers see that the city is serious about moving ahead and we have the council decision to move ahead, then I believe we will find the service providers will be much more interested in talking seriously about things like letters of intent. We are getting strong feelings from the service providers thus far that they want to partner with us, but it has not come to that yet. Quite frankly, we really have not had the time to spend as much time with the service providers as we would like to. It was a matter of getting this study back before the UAC and the City Council and have some preliminary discussions based upon the RFIs. We will definitely follow up as soon as the council acts to try and solidify things.

Chairman Johnston: I, too, want to commend you highly on this work. This is a venture that, as I see it, got off to an extremely shaky start at the beginning, and we were not quite sure where it would go. I voted in favor of proceeding at the time, although I made sure it was probably just an insurance policy in case we might be missing something. As we started into the early phases of this, I was very unsure as to whether we really were moving toward something that would work. I think it came unglued a little bit in the middle of Phase 3. Staff came in and rescued Phase 3, went back and got approval to proceed, again with a little bit of concern, so to some extent, I feel that in Phase 4, which staff has had responsibility for, albeit with some assistance with Mr. Rozzelle, it was rather marvelous that you have been able to pull something together that makes some sense here and which utilizes our assets and provides relatively small risk for the city and the utility. So I really commend you on all of that.

I am very pleased to see that it will reside within the electric utility. In the various discussions along the way, there was a fair amount said about where the $1,860,000 was going to come from and who should fund it. Frankly, I think it is much more than that. The conduit, as I see it, is owned by the electric utility. If this was going to be given to another venture, I would want to see the electric utility being compensated for the use of the conduit. So it really is not just the reserve money for pulling in new fiber and funding the soft

position. It is actually the electric utility's assets in terms of conduit and poles that are being used. At this point in time, it really makes very good sense for it to reside there. As you know, I have been a part of the Telecommunications Advisory Panel, so I have had a lot of questions along the way. I do not at this point. They have been answered, and I will be very happy to support this recommendation. Shall we have a motion?

Commissioner Eyerly: In view of the fact that Paul Grimsrud will not be making any more motions this year, I suggest he make this motion which we all seem to be in favor of.

MOTION: Commissioner Grimsrud: I move that we approve the staff recommendation for proceeding with the implementation of the recommendations.

SECOND: By Commissioner Sahagian.

MOTION PASSES: Chairman Johnston: That passes unanimously on a vote of 4-0 with Commissioner Chandler abstaining due to a conflict of interest.

Mr. Strojny: This goes to the City Council on August 5th.

Chairman Johnston: Thank you very much for your fine work.

(END OF EXCERPT)

City of Palo Alto

Utilities Advisory Commission

Wednesday, January 10, 1996
City Council Conference Room

EXECUTIVE SUMMARY

THIS SUMMARY OF CONDENSED EXTRACTS FROM THE FULL MEETING MINUTES HAS THREE SECTIONS:
POLICY ISSUES - A BRIEF STATEMENT OF ANY ITEMS THAT ARE BELIEVED TO NEED A POLICY DECISION OR GUIDANCE FROM THE CITY Council.
KEY ISSUES - A BRIEF STATEMENT OF SIGNIFICANT ITEMS DISCUSSED;
MINUTES HIGHLIGHTS - SHORT EXTRACTS FROM THE MEETING SHOWING THE GIST OF DISCUSSION, ALL MOTIONS AND VOTES, AND A NUMBER IN PARENTHESIS INDICATING THE PAGE OF THE FULL MINUTES WHERE MORE DETAILED INFORMATION ON THE SUBJECT MAY BE FOUND.

POLICY ISSUES

P-1. Telecommunications Feasibility Study: Staff presented the results of the consultant's report on Phases 1, 2, and 3 and the staff prepared a supplemental report for Phase 3 to the UAC. These reports had previously been reviewed by the Telecommunications Advisory Panel (TAP). The UAC recommends that the City Council adopt the staff recommendations to:

1. Modify the original approach to Phases 4 and 5 of the Telecommunication Strategy Study;

2. Terminate Contract Number C5077724 with the ICT Group; and

3. Shift the responsibility of completing Phases 4 and 5 of this five-phase study to staff, with limited technical assistance provided by one or more consultants.

KEY ISSUES

K-1. The Commission requested that the staff revise materials regarding water and gas main leaks to reflect both age and type of pipe, so that age can be controlled for in evaluating which sorts of pipe have been most prone to leaks, and to help develop any revisions in the replacement timetable.

K-2. Staff reviewed for the UAC the PUC's December 20, 2995 deregulation action, and noted that by 1998 large power aggregators (who might aggregate residential buyers as well) would have a choice of suppliers, and by 2003 all customers would potentially have a choice. Because the investor-owned utilities will be able to recover costs of uneconomical investments over a short period, they will also be formidable competitors.

K-3. Staff informed the Commission that any action that would have a dramatic impact on the City's relationship with Western, and the availability of federal power, appears to have been deferred until 1997.

Interview with Consultant for Utilities Organizational Review

KPMG, one of four consultants selected for interviews, made a half-hour presentation followed by questions from the task force and the UAC.

Agenda Item 6 - Consent Calendar

None.

Unfinished Business

Telecommunications Feasibility Study Alternatives

Mr. Bernie Strojny discussed the issue of telecommunications. He said that staff was here in the spring of 1995, talking about this issue. At that time, the UAC endorsed the staff recommendation to move ahead with the telecommunication feasibility study, and on May 8th of last year, the City Council approved the retaining of a consultant, the ICT Group, and a budget amendment ordinance to fund what amounts to a five-phase study to study the issue of telecommunications in the City of Palo Alto and what role the City might play in that. At the same time, a Telecommunications Advisory Panel was formed to work with the staff in evaluating and assessing the work of the consultant, and also provide feedback to the staff on the consultant's work.

The deployment of telecommunications in Palo Alto has been based upon market conditions and the individual needs of corporations who can provide some services to certain segments of the community. Our objective here is to accelerate deployment of a full range of communications infrastructure to all businesses and residences throughout the City.

The second objective is to decrease costs of telecommunications services.

The next objective relates to quality. Our goal is to provide the highest quality in both conventional and advanced telecommunications services that would result from any City involvement.

Our last objective relates somewhat to the decreased cost area is enhancing competition among telecommunications service providers. Those four objectives have been the objectives that have guided us as we prepared the recommendations we are asking you to endorse this evening.

Mr. Strojny then briefly discussed what has been occurring in other agencies in California.

Mr. Strojny summarized the report stating the study is a five-phase study. The ICT Group of Mountain View, our consultant, has completed Phases 1, 2 and 3. The Telecommunications Advisory Panel has reviewed all three of those phases. In Phase 3, ICT did conduct a Preliminary to Alternative Assessment. the staff and the Telecommunications Advisory Panel felt that once we had reviewed that information, there was some supplemental information that would be extremely useful to the TAP, as well as to the community as a whole, that would focus on the Leased Access Alternative. Staff has provided a supplemental report to ICT's report that provides additional information on the assessment of the alternatives. There are

two remaining phases. Phase 4 is a comparative analysis of alternatives. Finally, if out of that process an alternative emerges that we feel works for this community, a business plan would be developed as part of Phase 5.

Mr. Heimke presented an overview of the study.

Chairman Johnston introduced members of the public who requested to speak on the study.

John Kelly, president of the Board of Directors of Cable Co-op, said they are still evaluating the details of the report. It seems that the staff and the consultants have given a great deal of consideration to options that might involve participation or partnering with Cable Co-op. I have emphasized our desire to see if we could work out a cooperative arrangement with the city. We think that would be in the best interests of our member shareholders, as well as in the best interests of the citizens of Palo Alto.

We would also like to make it clear that we are here as a resource for you tonight.

During his discussion, Mr. Heimke stated that the leased option represented a family of options. The Executive Summary says "It is also recommended that the city proceed with Phase 4 of the study with detailed alternatives, definition and analysis work for alternatives covering independent City operations on the existing City infrastructure and coordination with Cable Co-op on a network upgrade and new service offerings." We think that was a very important observation.

That same report in the conclusions says "In expanding into larger communications ventures, there are two physical options. One is building a new City network, and two, is coordinating with Cable Co-op and expanding upon their current network infrastructure." Again, our sense of what we have heard tonight is that that second alternative is one that we would very much like to discuss with the City.

Also there is the statement made, "Coordination with Cable Co-op secures a large market presence in CATV. This dramatically enhances the economic stability of the City's investment and provides economic stability for Cable Co-op." We think that those are also very important points that should be given consideration in the future.

Finally, in the Recommendations section there are listed four specific points. One is the CPA lease of infrastructure, two is the CPA new network, three is the CPA and Cable Co-op coordination, and the fourth is the CPA and Cable Co-op coordination with switch voice and long distance. Again, it seems as though this is in keeping with what we have been trying to say to you.

Bob Moss said I am not representing Cable Co-op, even though I am on the board. I am speaking first as a member of PA Comnet, and second as an individual. One major concern is all of the valuations were fiscal and financial in nature. It is not just a dollars and cents issue when you talk about building a community.

The significant benefits which are difficult to price are very significant. It will encourage strong community identification and interaction.

I agree with the comments that John Kelly made about the advantages of using existing, locally based providers to work with the City and provide a wide range of services.

Keith Cooley, a member of PA Comnet, said PA Comnet is Palo Alto Community Networking Group. It is a grass roots organization comprised of local residents and members of community organizations who are interested in using computer networking to enhance community participation and interaction.

We fully support this study and its objectives, but feel it has been too narrowly focused on financial feasibility studies. The wider economic benefits, social benefits, community benefits, have not been given the attention that they deserve.

Tom Pacel said I am the organizer and initiator of a committee called the Community Committee for Local Cable. We are very much interested in local control and local ownership of our advanced communication system as it develops. We think this community is a little more unique than all other unique communities. This system that we imagine would be a more efficient, and hopefully a cheaper way, therefore a more effective way to keep the community members talking to each other and building better organized groups.

Gordon Fuller, a member of the Cable Co-op Board spoke as a concerned citizen, shared a few thoughts on the communications industry and said there probably should be a little more outreach to the community. I believe we are really writing history here today, even within our own community, making decisions. What we come up will probably be quite different than any of the things we are right now considering, but it will be our solution and will be one that we hope will make our community better. I salute you for your efforts.

Commissioner Eyerly asked Mr. Kelly about Cable Co-op revenue bonds and the financial situation?

Mr. Kelly responded with a history of the system we have reduced our total amount of debt since 1982. We have always envisioned refinancing the system. We believe that what has happened since 1991 is that the value of the system has increased, so this has been a sensible strategy. Essentially we moved from a position where we had a relatively small amount of equity in the system. Over five years now, the equity in the system itself has grown.

Chairman Johnston asked if they still have something on the order of the high thirty million dollars in debt and that you believe that the equity you have in the system is, in fact, growing. How do you value Cable Co-op now, if you were to take its assets and subtract off its liability?

Mr. Kelly responded, it is certainly in excess of $5 million, and very likely in excess of $10 million, if you are talking about the net equity

in the system. I think if you look at the equity in the system in 1991 and compare it to today, you will see there has been really phenomenal growth.

Chairman Johnston said my understanding of the system based on current revenues, it is difficult, if not impossible, to truly service debt in terms of paying the interest and principle payments,. Although you may have a value in the system, at some point, you need to do what you mentioned as being restructuring of that path, which could involve partnering or a number of things.

Mr. Kelly said we have serviced our debt since 1991. I think we are going to go to a clean audit in 1995. When we bought the plant in 1991, we knew we would have to refinance the system in 1998 or 1999. There was never a plan to retire all of the debt by 1998 or 1999. We are now in a different ball game. We are looking at the very strong possibility of competition from Pacific Bell. We have been considering how we could work with the City in light of those changes in the competitive environment. I feel that we have brought a lot of creativity to that analysis, and the City has brought a lot of creativity to the analysis, as well.

Commissioner Grimsrud asked questions on the telecommunications study objectives and stated the technology is changing by leaps and bounds, as well as the market, and I would think that another element up here might be timing. Should we do nothing now, and two years from now, do something because somebody might learn something over the next two years? Or should we make all of decisions based on our best information that we have now?

Mr. Habashi - Yes.

Mr. Strojny said we are trying to draw these alternatives into a workable, manageable recommendations. The timing aspect does become critical when you get into the analysis that will be contained in Phase 4.

Commissioner Grimsrud stated I appreciate the amount of work that was done in this report. We have a lot of good information, but I think this whole area of timing and the whole area of uncertainty is what concerns me. Is the market really there? I am not sure.

Mr. Heimke summarized the market information in the report and said it is a preliminary market analysis. Certainly before getting into any sort of venture, it should be expanded upon with a more detailed market analysis, plus involving focus groups.

Chairman Johnston spoke about some of the aspects of things we talked about in the Telecommunications Advisory Panel meeting and confirm that it is still very much going to be a part of Phase 4. The numbers that have been talked about are guesstimate at this stage. They have never been presented as anything more than that. One of the elements we talked about in the TAP meetings was that a significant role that the City has planned is as a facilitator. It is really trying to make something happen here for the benefit of the community. The issue that Paul raises about financial uncertainty is one that is very well recognized by the Telecommunications Advisory Panel. While it is contained in these reports, it perhaps has not been elevated to the level that I, felt it was discussed in our meetings. For example, there really is a very strong emphasis on things like

partnering and third-party financing. These are looked to as being essential, not only partnering but combining expertise. The partnering and third-party financing, and by third-party financing, you are talking about situations where the City may not actually own the system, for example, through some kind of Spectronet type of arrangement, but essentially, these are mechanisms by which the risk can be transferred. By doing that, you can transfer a small portion of the risk, or potentially, you can transfer all of the risk and simply become a facilitator. There are disadvantages to transferring all of the risk, because there is likely to be a loss of control or likely to be a loss of revenue or potential income if you do that. It is my understanding (and I just want to have it confirmed) that this basic transfer of risk to minimize financial uncertainty is very much a part of Phase 4.

Mr. Strojny responded, that is true.

Commissioner Eyerly asked have you investigated or do you know that through revenue bonds, you can finance the structure or not?

Mr. Strojny answered it could be one, given the way that revenue bonds have been used in somewhat similar instances. For that reason, it was put out as a possibility.

Commissioner Eyerly asked, will you address that revenue bond in Phase 4? (Yes) I take it from your report and recommendations that you have decided that the coaxial infrastructure that we now have is not usable.

Mr. Strojny answered, I don't think we are saying that. What we are saying is that for purposes of an advanced broadband telecommunications system, it would not be usable for that purpose. It has limitations.

Commissioner Grimsrud asked, in Phase 4, do you have a plan to try and put a value on certain levels of service?

Mr. Heimke responded, we would have to take a look at what it would take to accomplish that. Our intention is to take a look at those various families of alternatives that we have identified, and at the same time, take a look at the community benefits to be received from the alternatives.

Commissioner Sahagian asked, as one of the possible financing strategies, you talk about third-party financing. Are you talking about going out and just getting a third party, other than the City, to finance the infrastructure building?

Mr. Strojny answered, we have learned in Phase 3 is that there are now companies who are becoming involved with financial institutions who are interested in providing what we would call third-party financing for those kinds of municipal partnerships that can produce a return to the investor, that is the kind of thing we were thinking of as a possibility, along with the partner who could obviously be a Pacific Bell or it could be an AT&T or an MCI who brings to the field considerable capital that could be used to build the infrastructure.

Commissioner Eyerly asked, your report states that staff would like to finish up Phases 4, but you mention in your report on fiscal impact that

the cost of consultant assistance would be significantly less than the $44,000 remaining in the budget. You could not get this work done by the consultant for $44,000, could you?

Mr. Strojny responded, this study was arranged where ICT had originally agreed to perform Phases 1 through 5 for $135,000. We have gone through Phase 3 and have kept within the budget. We feel that staff can assume more responsibility than we had originally thought in Phase 4, and use the consultant assistance as needed to supplement staff.

Commissioner Eyerly said, you have the money, but you have not told us how much staff time is involved, which is money, too, isn't it?

Mr. Strojny responded, yes, we have been working with that, too, on how we can make sure that that works in Phase 4 as it has in Phases 1 through 3. We think that at this stage, we can have staff assume responsibility for Phase 4. Ed may want to speak to that in terms of how we are arranging the staff.

Mr. Mrizek said the utilities has taken on the role of supporting the City Manager's office in the study. We have provided a member of our staff to work on this study. We plan to utilize talents of staff to continue that process through Phase 4.

Chairman Johnston added, it was felt by the Telecommunications Advisory Panel that the best value of the consultant came from their expertise in collecting data. They provided City staff with a substantial mount of data. But in point of fact, I think staff's capabilities in terms of analysis of that data is actually better, frankly, than the consultant. It is my opinion that it would be better, once that data is collected, to use staff to complete Phase 4.

Commissioner Eyerly said I agree with you.

Commissioner Grimsrud added, the primary consideration is not so much the cost savings but that we think we get a better product.

Chairman Johnston said absolutely. This was not motivated by an objective of trying to save $44,000. We felt that we now have the data and we have the staff with very good analytical capabilities of handling that.

MOTION: Commissioner Eyerly: I recommend the staff recommendation.

SECOND: By Commissioner Sahagian.

MOTION PASSED 4-0 with Commissioner Chandler absent.

(End of Excerpt)